

UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA

ANDREA M. WILLIAMS and
JAMES STEWART, on behalf of
themselves and all others similarly
situated,

Plaintiffs,

v.

APPLE INC.,

Defendant.

Case No. 5:19-cv-4700-LHK

Expert Report of Lorin M. Hitt

January 29, 2021

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SOUGHT TO BE SEALED**

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I. Assignment

1. I was asked by counsel for Apple Inc. (“Apple”): (i) to evaluate whether putative class members, as defined in the First Amended Class Action Complaint,¹ are similarly situated such that a common method can be used to assess economic injury; and (ii) to review and respond to the expert report of Dr. Scott D. Swain (the “Swain Report”)² and the expert report of Dr. Russell W. Mangum III (the “Mangum Report”)³ on issues relating to the calculation of economic injury to the proposed class.⁴ In particular, I was asked to evaluate whether the analyses presented in the Swain Report and in the Mangum Report provide a reliable basis for calculating economic injury to the proposed Damages Class.

II. Qualifications

2. I am the Zhang Jindong Professor of Operations, Information and Decisions (OID) at the University of Pennsylvania, Wharton School. As a member of the Information Strategy and Economics Group (ISE), my research and teaching focus on the economics of consumer behavior, firm organization, and market structure, with particular emphasis on the role of information on pricing, performance, and competition.

3. I received my Ph.D. in Management from the Massachusetts Institute of Technology Sloan School of Management in 1996, and my Sc.B. (1988) and Sc.M. (1989) degrees in Electrical Engineering from Brown University. The majority of my Ph.D. coursework was in economics and statistics, and my doctoral dissertation was supervised in part by Zvi Griliches (Harvard), a former Chair of the American Economic Association (AEA) and a pioneer in methods for understanding the relationship between prices and quality change in complex

¹ First Amended Class Action Complaint, *Andrea M. Williams and James Stewart, On Behalf of Themselves and All Others Similarly Situated v. Apple Inc.*, United States District Court for the Northern District of California, Case No. 5:19-cv-04700-LHK, April 27, 2020, (“First Amended Complaint”), ¶ 44.

² Expert Report of Scott D. Swain, January 8, 2021.

³ Expert Report of Russell W. Mangum III, Ph.D. In Support of Plaintiffs’ Motion for Class Certification, January 8, 2021.

⁴ Plaintiffs seek to certify two classes. Relevant to this report is Plaintiffs’ proposed class of “[a]ll persons in the United States who paid for a subscription to iCloud at any time” during the period September 16, 2015, to October 31, 2018 (the “Damages Class”). See Plaintiffs’ Notice of Motion, Motion, and Memorandum in Support of Their Motion for Class Certification, *Andrea M. Williams and James Stewart, On Behalf of Themselves and All Others Similarly Situated v. Apple Inc.*, United States District Court for the Northern District of California, San Jose Division, Case No. 5:19-cv-04700-LHK, January 9, 2021. (“Plaintiffs’ Motion for Class Certification”), p. 1. Plaintiffs also seek to certify a second class of subscribers seeking injunctive relief comprised of all persons meeting the definition of the Damages Class, and who are “current paying subscribers of iCloud in the United States as of the date the Court enters its order granting Plaintiffs’ motion for class certification.” See Plaintiffs’ Motion for Class Certification, p. 1.

products. I am a member of the AEA, INFORMS (Operations Research and Management Science Society), Sigma Xi (Scientific Research Society), and Tau Beta Pi (Engineering Honor Society).

4. I have taught undergraduate, masters, doctoral, and executive education level courses at the University of Pennsylvania and the Massachusetts Institute of Technology on competition and customer pricing in a variety of commercial and consumer markets, information systems management, economics of technology, and data analysis. In my Ph.D. seminar, I cover a variety of empirical methods used in economic research, including methods for estimating product demand and supply, pricing products, measuring the effect of external events on market prices, and valuing individual product features in differentiated products using techniques developed by both econometricians and marketing researchers. I am a twelve-time winner of the Wharton Undergraduate Teaching Award and have received the Wharton-wide Hauck Award and University-wide Lindback Award for distinguished teaching.

5. My research is characterized by rigorous economic analysis and I am well versed in econometric and statistical methods. A number of my published research papers focus specifically on modeling demand in consumer and commercial markets, assessing these models using market data, and using this information for pricing or product design. My research has been published in top-tier economics and management journals, including the *Quarterly Journal of Economics*, the *Review of Economics and Statistics*, the *Journal of Economic Perspectives*, *Brookings Papers on Economic Activity*, *Management Science*, *Information Systems Research*, and other top-tier outlets.

6. I formerly served as a Department Editor at *Management Science*, and as a reviewer for a number of management and economics journals including *American Economic Review*, the *Quarterly Journal of Economics*, *Information Economics and Policy*, *Journal of Industrial Economics*, *Journal of Law, Economics, and Organization*, *Managerial and Decision Economics*, *Marketing Science*, *Review of Economics and Statistics*, and *MIT Sloan Management Review*, among others.

7. I have prior experience in litigation matters where I evaluated the value of a product or product features in a variety of information technology products including smartphones, tablets,

personal computers, storage appliances, memory devices, microprocessors, networking equipment, communications chipsets, operating systems, database software, and online travel services. I have also done similar analyses for other retail products including cosmetics, automobiles, all-terrain vehicles, trucks, furniture, refrigerators, and wet dry vacuum cleaners. My expert opinions in these matters have been accepted in federal, state, and city courts.

8. I have specific experience in consumer class actions including the use of hedonic price analysis, conjoint analysis, contingent valuation and other types of consumer surveys, and the analysis of market price data for the purposes of class certification and measurement of economic injury. This experience includes analysis of the results of conjoint surveys for the purposes of class certification and the determination of economic injury from alleged product defects or misrepresentations.

9. My Curriculum Vitae is attached as Appendix A and a list of my testimony in the past five years is attached as Appendix B.

III. Summary of Allegations and Background

10. Plaintiffs Andrea Williams and James Stewart (“Plaintiffs”) allege that Apple promised users of its iCloud service (“iCloud Service” or the “Service”) that their iCloud user data would be “sent to and stored by Apple” but violated that promise by storing users’ data in cloud storage facilities owned and operated by other entities.⁵ Specifically, according to Plaintiffs, from September 16, 2015 to October 31, 2018 (the “Damages Class Period”),⁶ “Apple was selling iCloud storage as its own to subscribers, but actually reselling (unbeknownst to class members) cloud storage provided by Amazon or Microsoft.”⁷ Plaintiffs further allege that Apple “charge[d] a premium for its iCloud service because subscribers placed a value on having the ‘Apple’ brand as the provider of the storage service.”⁸

11. Plaintiffs have submitted the Swain Report in support of their motion for class certification.⁹ The Swain Report describes the design and results of a conjoint survey (the

⁵ First Amended Complaint, ¶¶ 2–3.

⁶ Plaintiffs’ Motion for Class Certification, p. 1.

⁷ First Amended Complaint, ¶ 4.

⁸ First Amended Complaint, ¶ 4.

⁹ Plaintiffs’ Motion for Class Certification, p. 1.

“Swain Survey”) used to “estimate the reduction in market value, if any, resulting from a disclosure in Apple’s iCloud Terms of Service Agreement with its subscribers that it partly outsources iCloud storage service by diverting class members’ cloud content for storage on other companies’ servers located at other companies’ facilities.”¹⁰

12. In Dr. Swain’s conjoint survey, each of 411 respondents was asked to complete ten “choice tasks.”¹¹ According to Dr. Swain, each choice task “involved showing four cloud storage services (plus a ‘None’ option) and soliciting a purchase decision.”¹² Each option in each task was described in terms of six attributes: Brand (Apple iCloud, Dropbox, Microsoft OneDrive, Google Drive), Storage Size [50 gigabytes (“GB”), 200 GB, and 2 terabytes (“TB”)], Family Share (one user, or up to six users), Storage Location (“in-house” storage, or “partly outsourced” storage), Multi-device Sync (ability to sync multiple devices),¹³ and Monthly Price.¹⁴

13. The Swain Report details Dr. Swain’s estimates, based on the results of the Swain Survey, of the “price premiums” allegedly paid by class members¹⁵ for three iCloud Services (50 GB, 200 GB, and 2 TB storage sizes).¹⁶ To obtain these estimates, Dr. Swain’s analysis involved two steps. First, he processed the data from his survey using conjoint survey analysis software to generate numerical estimates representing survey respondents’ preferences for the different attributes in his survey (called “part-worths”). For example, one of Dr. Swain’s estimates of the preferences of a respondent shows a part-worth of 26 for the preference this individual has for a product with storage size of 50 GB, and a part-worth of 139 for 200 GB—indicating (because 139 is larger than 26) that this user prefers the larger storage size.¹⁷ In the second step, he used his estimated part-worths as inputs to a simulation of consumer choices. In this simulation, he attempted to calculate the difference in the price that respondents would be willing to pay for an iCloud product with “fully in-house” storage and one with “partly outsourced” storage, for each

¹⁰ Swain Report, ¶ 10.

¹¹ Swain Report, ¶ 27.

¹² Swain Report, ¶ 26.

¹³ Specifically, Dr. Swain describes this attribute as the ability to sync multiple devices across operating systems. One level of this attribute involves the ability to sync across iOS, MacOS, and Windows, and the other level involves the ability to sync across iOS, MacOS, Windows, and Android. See Swain Report, ¶ 32.

¹⁴ Swain Report, ¶¶ 26, 32.

¹⁵ References to “class members” are to putative class members of the Damages Class.

¹⁶ Swain Report, ¶ 93.

¹⁷ See Swain Report production materials.

of the three storage sizes.¹⁸ Dr. Swain translated his estimates to a percentage he describes as a “market value difference.”¹⁹ He claims his market value difference is the price premium that class members paid during the Damages Class Period. Specifically, Dr. Swain measured a price premium of 34.8% for the 50 GB service, 41.7% for the 200 GB service, and 46.2% for the 2 TB service.²⁰

14. Plaintiffs also submitted the Mangum Report in support of their motion for class certification.²¹ The Mangum Report describes Dr. Mangum’s “economic damages framework” that he applies to Plaintiffs’ allegations in this case.²² Dr. Mangum states that his “economic impact analysis relies on the survey analysis and corresponding conjoint analysis conducted by Professor Swain,” and that he “coordinated with Professor Swain on the development of the conjoint analysis as part of the alignment of the analysis with the claims in this matter and the economic theory underlying the assessment of damages.”²³

15. The Mangum Report does not include an economic analysis and rather presents Dr. Mangum’s mechanical calculation of alleged class-wide damages based on a multiplication of total amount paid by putative class members and the percentage price premium estimated by Dr. Swain.²⁴ Specifically, Dr. Mangum first calculated the total amount paid by iCloud subscribers over the Damages Class Period, based upon the number of months that iCloud users subscribed to a 50 GB, 200 GB, or 2 TB product and Dr. Mangum’s estimates of the prices they paid. Then he multiplied his estimate of the total amount paid for each service—50 GB, 200 GB, and 2 TB—by the corresponding percentage price premium estimated by Dr. Swain.²⁵ Dr. Mangum calculates damages of \$ [REDACTED] for users of the 50 GB service, \$ [REDACTED] for users of the 200 GB service, and \$ [REDACTED] for users of the 2 TB service, for a total of \$ [REDACTED].²⁶

¹⁸ Swain Report, ¶ 86.

¹⁹ Swain Report, Exhibit H.

²⁰ Swain Report, ¶ 93.

²¹ Plaintiffs’ Motion for Class Certification, p. 1.

²² Mangum Report, Section III.

²³ Mangum Report, ¶ 36.

²⁴ Mangum Report, ¶¶ 52–53, Table 8, and Exhibit 8.

²⁵ Mangum Report, ¶¶ 51–54.

²⁶ Mangum Report, Table 8.

IV. Materials Relied Upon and Compensation

16. In reaching my conclusions, I have reviewed product literature, public press, academic research, various redacted deposition testimony and legal filings, and various Apple internal and external documents. I have also reviewed the Swain Report and backup materials, the Mangum Report and backup materials, and Dr. Swain's deposition testimony. In addition, I reviewed the expert report that Dr. Carol Scott submitted on behalf of Apple in this matter.²⁷ Appendix C lists the materials I have relied upon in forming my opinions in this matter.

17. I am being compensated at a rate of \$1,050 per hour. I am being assisted in this matter by staff at Cornerstone Research who are working at my direction. I receive compensation from Cornerstone Research based on its collected staff billings for its support of me in this matter. Neither my compensation in this matter nor my compensation from Cornerstone Research is in any way contingent on the content of my opinion or the outcome of this or any other matter.

18. My work in this matter is ongoing and I reserve the right to update my opinions as additional information becomes available.

V. Summary of Opinions

19. The damages methodology offered by Dr. Swain and Dr. Mangum, based on a choice-based conjoint analysis, does not and cannot measure economic injury under Plaintiffs' theory of harm.²⁸ Under Plaintiffs' theory of harm, putative class members overpaid for iCloud Service due to the challenged language. Thus, damages, if any exist, should be measured by the difference between the *market prices* actually paid for the iCloud Service in the real world and the *market prices* at which the iCloud Service would have been sold in the but-for world in which the challenged language is removed.

20. Because Dr. Swain's estimates of percent reduction in value ignore supply-side factors that affect market prices, they represent consumers' willingness to pay and not a market price. Dr. Mangum makes clear in his report that the reduction in "economic value" represented by Dr. Swain's estimates is a demand-side measure, i.e., willingness to pay. Dr. Mangum incorrectly

²⁷ Expert Report of Dr. Carol A. Scott, January 29, 2021 ("Scott Report").

²⁸ References in this report to Plaintiffs' proposed damages methodology in no way endorse the use of choice-based conjoint analysis to measure damages based on a price premium theory of harm.

claims that one does not need to calculate a but-for market price in order to calculate damages under Plaintiffs' theory of harm.

21. Because willingness to pay is a demand-side factor, it does not itself determine market prices in the actual world and similarly cannot be relied upon, by itself, to model market prices in the hypothetical but-for world. Moreover, the use of a willingness-to-pay measure by Plaintiffs' experts likely leads to an overestimate of damages even if willingness to pay were correctly measured—which it is not. Even if consumer willingness-to-pay decreased in the but-for world, the effect on market prices could be zero. Plaintiffs' experts imply that the but-for market price change is equal to the decrease in consumer willingness-to-pay, but this incorporates the wholly unsupported and strong assumption that Apple would supply the exact same number of units in the but-for world, even if it means selling at a loss.

22. Not only does Dr. Swain fail to estimate market prices in the but-for world, but also his conjoint survey and analysis fail to incorporate the actual prices of iCloud subscriptions appropriately. First, his survey uses a maximum price of \$12.99 for the 2 TB service, despite the fact that the 2 TB service was \$19.99 for more than half of the Damages Class Period. In addition, his analysis of the survey data does not use the prices from the survey but rather non-numeric "lower," "middle," and "higher" price levels. Lastly, his analysis improperly extrapolates beyond the range of prices used in the Swain Survey to yield estimates of price reductions as high as 46.2%.

23. A powerful indicator of the unreliability of Dr. Swain's conjoint model results from comparing its predictions to real-world data and outcomes; this is referred to in the research design literature as a test of external validity. First, contrary Dr. Swain's conjoint model which predicts a large effect from a disclosure about Apple's storage practices, there was no apparent effect on iCloud's market prices or quantities (i.e., number of subscriptions) when public news sources reported that Apple was storing some of its users' iCloud Service data on Google's computer servers. Second, the predicted relative market shares of the 50 GB, 200 GB, and 2 TB iCloud Services from Dr. Swain's conjoint model are inconsistent with their actual relative market shares, showing that Dr. Swain's consumer preference estimates are deeply flawed. Third, real-world market data from iCloud competitor Dropbox shows that it enjoyed no apparent positive reaction in the form of increased prices or quantity sold when it announced that

it had completed a switch from fully outsourced storage to 90% in-house storage. Finally, the behavior of the named Plaintiffs is inconsistent with Dr. Swain's model (but consistent with market data), as they continue to pay the same prices for iCloud despite their knowledge of Apple's storage practices. Because the predictions of Dr. Swain's conjoint model do not comport with actual market outcomes, none of his model's predictions should be considered reliable and his model should be rejected.

24. Dr. Swain's analysis generates estimates of consumer preferences that are inconsistent with rational consumer behavior such as consumers who prefer higher prices to lower prices or who would pay more for a strictly inferior product. Fully 66% of respondents showed at least one irrational preference in Dr. Swain's survey data, indicating that his survey and results are unreliable.

25. Finally, Dr. Swain's conjoint analysis ignores significant heterogeneity in preferences, switching costs, and information across putative class members. Because of this heterogeneity, there is no reason to believe that a change in iCloud's Terms and Conditions would have exactly the same effect across a large group of consumers purchasing different products over many years. In fact, Dr. Swain's own results reveal that the majority of his respondents do not have a statistically significant preference for fully in-house storage over partly outsourced storage.

VI. Plaintiffs' Proposed Methodology Does Not Measure Economic Injury under Plaintiffs' Theory of Harm

26. Plaintiffs claim that they and "class members have paid more for iCloud than they would have had Apple disclosed that the cloud storage provided to iCloud subscribers actually was being provided not by Apple, but by other third parties."²⁹ Based on this theory of harm, Plaintiffs' alleged damages should be measured by the difference between the *market prices* paid for the iCloud Service in the real world and the *market prices* that would have been paid for the Service in the "but-for" world—the prices at which Apple would have offered the iCloud Service without the challenged language.³⁰ Thus, Plaintiffs need to provide a methodology that can estimate market prices in the but-for world.

²⁹ First Amended Complaint, ¶ 40.

³⁰ See, e.g., Deposition of Scott D. Swain, Ph.D., January 22, 2021 ("Swain Deposition"), p. 130:12–23 ("Q. So I'm asking since you said the price premium could be computed, to do that, you would need to measure the market

27. In this section, I show that Plaintiffs have failed to provide such a methodology, not just to estimate market prices in the but-for world but also to match Plaintiffs' theory of harm. Although Dr. Swain acknowledges that supply-side factors must be accounted for to estimate a market price,³¹ his conjoint analysis cannot be used to estimate but-for market prices because it ignores supply-side factors. Accounting for supply-side factors is necessary for the estimation of the market equilibrium (i.e., the intersection of supply and demand) that determines prices and quantities in the but-for world. Dr. Swain refers to conversations with Dr. Mangum as the basis for his (incorrect) opinion "that the [conjoint analysis] methodology set forth in [his] report accounts for appropriate market supply-side factors."³² However, Dr. Mangum contradicts Dr. Swain, admitting in his report that the "reduction in economic value" calculated by Dr. Swain is a demand-side measurement. He argues that Dr. Swain's result can be used to calculate damages (i.e., it is a *market price* difference) because supply should be held fixed in the but-for world (a claim that lacks any economic basis), but his position is internally contradictory because he also admits that this framework does not involve calculating a but-for price formed by a market equilibrium between supply and demand.³³ Hence, Dr. Mangum's economic framework for damages does not match Plaintiffs' theory of harm because it uses as the key input, by his own admission, a demand-side-only measurement of reduction in "economic value," which is clearly not a market price difference.

prices in the actual world; correct? A. That's my understanding. Using real prices as part of determining the difference in value, that that's important. Q. And then you'd have to measure the market prices in the but-for world where the disclosure was made; correct? ... THE WITNESS: Yes").

³¹ Swain Deposition, p. 24:16–25 ("Q. And what do you understand market price to mean? A. I guess I would start by saying I wouldn't represent myself to be an economist. So -- but, you know, market price could be, you know, a price at which transaction takes place. Q. So is that your understanding of what 'market price' means? A. Yeah, something like that. Q. So is it -- have you ever thought of the phrase as meaning that market prices are determined by supply and demand factors? A. Yeah. That's what I was getting at with transaction. There's an agreement."); Swain Deposition, p. 131:2–23 ("But a market price reflects the -- when the demand and the supply meet; right and the price at which that point meets; right? A. Yes. Q. So then is your market value that same thing where it's where demand and supply meet? A. I think you could describe it that way").

³² Swain Report, ¶ 25.

³³ Mangum Report, ¶ 30.

A. Dr. Swain’s Survey and Analysis Cannot Be Used to Estimate Market Prices and Therefore Cannot Be Used to Calculate Plaintiffs’ Alleged Overpayment

1. Measuring but-for market prices requires consideration of both demand-side and supply-side factors

28. Market prices are determined by both supply and demand.³⁴ Supply is the relationship between the price of a good and the amount of that good that sellers are willing and able to sell at that price.³⁵ Similarly, demand is the relationship between the price of a good and the amount of that good that buyers are willing and able to purchase at that price.³⁶

29. Determining demand requires, at a minimum, determining consumers’ “willingness to pay” for a product (“WTP”), which represents “the maximum amount that a buyer will pay for a good.”³⁷ The WTP of all of the potential buyers in a market can be used to derive the demand for a product in that market.³⁸ The “law of demand” states that, all else equal, the quantity demanded of a good falls when the price of the good rises.³⁹

30. Determining supply requires, at a minimum, identifying the cost structure and other characteristics of producers (all relevant competitors in the market), to determine their “willingness to sell.”⁴⁰ The willingness to sell of producers depends on their costs, including not just the cost of producing or sourcing a product, but “the value of everything a seller must give up to produce [or retail] a good.”⁴¹ The willingness to sell of all potential sellers in a market can be used to derive the supply curve of a product in that market.⁴² The “law of supply” states that, all else equal, the quantity supplied of a good rises when the price of the good rises.⁴³

31. Critically, the market price (also referred to as the market “equilibrium” price) of a product is determined by the interaction of supply and demand, and it is not possible to predict

³⁴ See, e.g., Mankiw, N. G. (2008), *Principles of Microeconomics*, 5th ed., Mason, OH: South-Western Cengage Learning. (“Mankiw (2008)”), p. 65. (“Supply and demand are the forces that make market economies work. They determine the quantity of each good produced and the price at which it is sold.”)

³⁵ Mankiw (2008), p. 73.

³⁶ Mankiw (2008), p. 67.

³⁷ Mankiw (2008), p. 138.

³⁸ See, e.g., Mankiw (2008), p. 139.

³⁹ Mankiw (2008), p. 67.

⁴⁰ See, e.g., Varian, H. R. (1992), *Microeconomic Analysis*, 3rd ed., New York, NY: W. W. Norton & Company, Inc. (“Varian (1992)”), pp. 215–232; Mankiw (2008), pp. 143–146.

⁴¹ Mankiw (2008), p. 143.

⁴² See, e.g., Mankiw (2008), p. 143.

⁴³ Mankiw (2008), p. 73.

the market price of a product without first determining both supply and demand.⁴⁴ Similarly, the market quantity, the number of units demanded and supplied at the market price, is also determined by the interaction of supply and demand. Prices and quantities in the actual world reflect the intersection of supply and demand under the conditions of the actual world. However, they do not reflect what supply and demand would be in a but-for world, such as a world without the challenged language.

32. According to Plaintiffs, in the but-for world, absent the disputed language in the iCloud Terms and Conditions about Apple's storage practices, they would not have agreed to pay Apple as much as they did for their iCloud subscription.⁴⁵ In other words, Plaintiffs claim that demand for iCloud products would have shifted downwards in the but-for world.⁴⁶ Even if Plaintiffs were correct in their claim that demand for iCloud products would have shifted in the but-for world, this assumption is not sufficient to determine the change in market price in the but-for world, if any, because neither supply nor demand by itself determines prices in the actual or but-for worlds. It is the interaction between supply and demand in the but-for world that determines the but-for market price. Plaintiffs simply cannot estimate the but-for price without taking into account the supply-side factors *in the but-for world*.

33. Determining the effect of a change in demand on the market price (if any) requires a characterization of supply conditions. For instance, if supply were such that producers were willing to supply any quantity demanded by the market at a fixed price, then the but-for price would be identical to the actual price. That is, a higher demand due to a lack of disclosure would result in no price premium and there would be no damages from failing to make a suitable disclosure. This could be because the producer would prefer to sell fewer products in the but-for world rather than allowing the but-for price to drop. This is why performing an appropriate analysis of supply-side factors in the but for world is a critical task to determine the but-for market price—a task that Plaintiffs have failed to do.

⁴⁴ See, e.g., Nicholson, W. (1998), *Microeconomic Theory: Basic Principles and Extensions*, 7th ed., Fort Worth, TX: The Dryden Press, p. 11 (“[J]ust as you cannot tell which blade of a scissors does the cutting, so too you cannot say that either demand or supply alone determines price.”).

⁴⁵ First Amended Complaint, ¶ 65.

⁴⁶ See, e.g., Mangum Report, ¶ 31 (“Given consumer preferences and tastes, learning of the third-party data storage facilities may reduce consumers’ threshold price for willingness to pay for iCloud subscriptions. From an economic perspective, the demand curve is comprised of these maximum threshold prices so any reduction to value metrics shifts the demand curve downward.”).

34. Plaintiffs' experts acknowledge that the but-for market price and quantity are determined jointly by the interaction of demand in the but-for world and the supplier's response to the change in demand. For example, according to Dr. Swain, "supply and demand do meet each other at [the but-for price]."⁴⁷ Similarly, Dr. Mangum acknowledges the role of supply and demand in the determination of the market price and quantity in the but-for world when he explains that "iCloud prices and quantities may be reduced" in the but-for world compared to the actual world.⁴⁸ However, as I explain in further detail below, Dr. Swain does not incorporate supply-side considerations in his analysis and therefore he cannot estimate but-for market prices.

2. Dr. Swain's conjoint is purely a demand-side analysis so it cannot estimate the change in market prices

35. Dr. Swain describes his measure of "market value" as the *price* that consumers and suppliers determine together—i.e., the market price.⁴⁹ He then calculates a "market value difference" which he claims to be the difference between the *actual price* that consumers paid and the *but-for price* they would have paid to Apple in the but-for world, absent the challenged language.⁵⁰ While Dr. Swain may rely on Apple's data to calculate the actual prices paid by putative class members, his methodology does not yield but-for *market prices* because his analysis ignores supply-side factors. Therefore, his purported "market value difference" is not a difference in market prices and not appropriate to estimate damages in this matter.

36. To measure the alleged economic loss, Dr. Swain needs to propose a method that (1) can model both supply and demand in the relevant market in both the actual and but-for worlds, and (2) can account for the profit-maximizing choices of Apple as well as other cloud storage

⁴⁷ Swain Deposition, p. 131:15–23 ("Q Right. I'm asking, though, for determining the market prices in the but-for world where Apple would have made a corrective disclosure, would those prices have been determined by both demand and supply factors? ... A. I guess I would just say that, you know, ultimately supply and demand do meet each other at this point"). See also Swain Deposition, p. 24:21–25 ("Q. So is it -- have you ever thought of the phrase as meaning that market prices are determined by supply and demand factors? A. Yeah. That's what I was getting at with transaction").

⁴⁸ Mangum Report, footnote 67.

⁴⁹ Swain Deposition, p. 126:16–17 ("I think the price that the consumer and the supplier agree on is the market value").

⁵⁰ See, e.g., Swain Report, ¶ 23 ("[A] reduction in market value can be calculated as the price reduction needed to compensate a class"); Swain Report, ¶ 10 ("[A] reduction in market value, if any, can be used to compute the price premium paid by class members who purchased an identical iCloud subscription without such a disclosure under the iCloud Terms of Service Agreement").

providers that participate in the market. Dr. Swain has not done so in this matter, and he has not done so previously:

Q. Okay. So have you ever used a conjoint survey to determine a market price?

A. No.⁵¹

37. Dr. Swain's results are based solely on the Swain Survey, which collects information from a sample of consumers who can only provide information about their preferences—the demand side of the market. Because the only data collected by the Swain Survey are respondents' answers, the survey cannot generate results for anything other than consumer preferences and information, regardless of whether it showed respondents the actual prices charged by Apple or any other reasonable set of prices.

38. Analyzing supply-side factors involves analyzing producer input prices, producer expectations, the number of sellers, and the nature of competition in the market, among other factors.⁵² None of the steps in Dr. Swain's analysis involves analyzing such factors, such as the characteristics of Apple's cost structure, the cost structure of Apple's competitors, or the competitive interactions among Apple and other cloud storage providers.⁵³ The but-for world in Dr. Swain's proposed analysis does not incorporate the factors affecting Apple's willingness to supply (e.g., Apple's cost structure and its ability to expand or contract its storage capacity, whether in-house or outsourced) or Apple's decisions regarding changes to promotional strategy, advertising, or other strategies that would enable Apple to most profitably sell its products.⁵⁴ However, Dr. Swain acknowledged in deposition that there are "different things that Apple could or couldn't do" in the but-for world and that "they could do almost anything."⁵⁵ In other words,

⁵¹ Swain Deposition, p. 26:1–3.

⁵² See, e.g., Varian (1992), pp. 215–232; Mankiw (2008), pp. 75–76.

⁵³ See, e.g., Swain Deposition, p. 160:18–22 ("Does your study look at or examine Apple costs? A. I don't have additional collected data of that sort that is involved which I would have put into my report").

⁵⁴ See, e.g., Mankiw (2008), pp. 73–76, 143–144; Allenby, G. M., J. Brazell, J. R. Howell, and P. E. Rossi (2014), "Valuation of Patented Product Features," *Journal of Law and Economics*, 57, 3, 629–663 ("Allenby et al. (2014)"), p. 630 ("However, a conjoint survey, in and of itself, is not adequate to form the basis for equilibrium firm profit calculations. Not only must we calibrate demand for products, but we must also compute industry equilibria. This requires measures of costs, a demand system not only for the focal product but also for the major competing products, and an equilibrium concept.").

⁵⁵ Swain Deposition, p. 135:13–17 ("Q. Is it your opinion that if Apple had not made the alleged misrepresentation the number of subscriptions sold would have been the same? A. I guess Apple could, you know, it's -- different things Apple could or couldn't do"); Swain Deposition, p. 137:17–22 ("Q. What could they have done. You said Apple could have done some things in response to the disclosure? What are some of the things that you think Apple could do? A. You know, I guess in the hypothetical they could do almost anything").

he acknowledges that Apple could have been willing to sell fewer units in the but-for world (e.g., to keep prices higher to maintain profitability) or to make other changes to its iCloud service or promotion in response to the hypothetical lowered demand resulting from a disclosure.

39. Furthermore, it is not possible to predict reliably the price response to a change in demand in a competitive market without a complete characterization of supply and demand for *all* participants (i.e., all cloud storage providers including Apple). In the but-for world, other cloud storage providers could react in a variety of ways, including by changing the price, characteristics, and availability of alternative cloud storage products.⁵⁶ Dr. Swain does not consider the cost structures of other cloud storage providers, those providers' ability to change prices, or any non-price reactions,⁵⁷ and instead assumes that cloud storage providers in the but-for world are static.

40. In summary, Dr. Swain has not offered a method that can sufficiently approximate supply in the market for the iCloud Service. Due to its inability to account for a variety of factors that affect market prices on the supply side, Dr. Swain's proposed method cannot estimate market prices. He therefore cannot calculate a price premium under Plaintiffs' theory of damages.

3. Dr. Swain's analysis does not account for appropriate supply factors and does not rely on actual market prices

41. Despite the absence of any analysis of supply-side factors, Dr. Swain claims that his methodology "accounts for appropriate market supply-side factors so that [his] survey would accurately measure changes in market value or price premiums" because his survey used actual prices.⁵⁸ Dr. Swain's claim is misleading for at least three reasons. The first is that *actual* market prices do not provide information about supply or demand in the *but-for* world. The second is that Dr. Swain's analysis does not use actual market prices in the estimation of

⁵⁶ Allenby et al. (2014), p. 630. To the extent that Dr. Swain's hypothesized reaction for Apple is restricted to changing product prices rather than the full range of strategies Apple could pursue, even if such price changes could be correctly calculated, they would overstate damages. This is because Apple could only gain more profit from having more flexibility to use non-price strategies when responding; it would never earn less profit because Apple could always ignore this flexibility and simply change price if that were optimal.

⁵⁷ See, e.g., Allenby, G., J. Brazell, J. Howell, and P. Rossi (2013), "Using Conjoint Analysis to Determine the Market Value of Product Features," in *Proceedings of the Sawtooth Software Conference*, 341–355 ("Allenby et. al. (2013)") at 342 ("To compute equilibrium outcomes, we will have to make assumptions about cost and the nature of competition and the set of competitive offers. Conjoint studies will have to be designed with this in mind. In particular, greater care to include an appropriate set of competitive brands, handle the outside option appropriately, and estimate price sensitivity precisely must be exercised.").

⁵⁸ Swain Report, ¶ 25.

consumer preferences, but instead uses three price levels: “low,” “middle,” and “high.” Finally, the Swain Survey did not show respondents the actual price (or even near the actual price) of the 2 TB subscription that prevailed during the majority of the Damages Class Period. I explain these three reasons next.

42. The first reason why Dr. Swain’s claim is misleading is that, even if actual market prices are the result of the interaction of supply and demand in the actual world, they do not reflect demand-side or supply-side factors in the *but-for world*. As discussed in Section VI.A.1, both demand and supply-side factors may be different in the but-for world and they must be analyzed to determine the but-for price. As such, even if Dr. Swain’s analysis used actual market prices (which, as I explain next, it does not), Dr. Swain would still need to account for appropriate supply-side factors in the but-for world if he wanted to calculate the market price premium, if any, that consumers paid for the iCloud Service due to the disputed language. As I explain in Section VI.A.2, he did not.

43. The second reason why Dr. Swain’s claim is misleading is that, while the Swain Survey presents respondents a range of prices centered around the actual market prices, Dr. Swain’s analysis of the responses to his survey does not use the prices paid by iCloud users to generate estimates of consumer preferences.⁵⁹ Instead of relying on the actual prices of the different iCloud products in his survey, Dr. Swain’s analysis relies on non-numeric “price levels” representing the prices of multiple products at the same time. For instance, instead of estimating survey respondents’ preferences for the prices of \$0.99 for the 50 GB subscription, \$2.99 for the 200 GB subscription, and \$9.99 for the 2 TB subscription (the actual prices paid by iCloud Service users), Dr. Swain estimated survey respondents’ preference for a single “middle” price.⁶⁰ Figure 1 shows the prices used in the Swain Survey, and the non-numeric levels that Dr. Swain uses in his analysis. As Dr. Swain further explains, “[a]s far as the [conjoint analysis] design is concerned, there are only three price levels (lower, middle, higher).”⁶¹ Dr. Swain has not shown that his assumption to consider equivalent for the purposes of his analysis prices as different as

⁵⁹ Swain Deposition pp. 142:25, 143:1–7 (“Q. And then for your estimations of part-worths what are you using? A. Right. There so it’s the indication of whether it was the lower, middle or high or the one, two, three price. Q. So you weren’t using actual prices? A. I guess from a coding perspective you can say that”).

⁶⁰ Similarly, Dr. Swain transformed the prices of \$0.69, \$1.99, and \$6.99, to a single “low” price, and the prices of \$1.29, \$3.99, and \$12.99 to a single “high” price.

⁶¹ Swain Report, footnote 9.

\$0.99 and \$9.99 is appropriate.⁶² Similarly, Dr. Swain has not shown that the WTP estimates that he obtains from his methodology reflect consumer preferences for the actual market prices paid by iCloud Service users for specific products.

**Figure 1: Swain Survey Prices and the Levels Used in
Dr. Swain's Estimation of Part-Worths**

	Lower	Middle	Higher
50 GB	\$0.69	\$0.99	\$1.29
200 GB	\$1.99	\$2.99	\$3.99
2 TB	\$6.99	\$9.99	\$12.99

Source: Swain Report

44. The third reason why Dr. Swain's claim is misleading is because the Swain Survey showed respondents a range of prices between \$6.99 and \$12.99 for a 2 TB subscription, when in fact, for the majority of the Damages Class Period, the actual price of the 2 TB subscription was \$19.99. According to Dr. Mangum's data, iCloud's 2 TB subscription had a price of \$19.99 every month between August 2015 (the beginning of the Damages Class Period) and May 2017. That is, for 22 (or 56%) of the 39 months that encompass the Damages Class Period (ending in October 2018), iCloud's 2 TB subscription had a price more than 50% higher than the highest price used in the Swain Survey.⁶³ Academic research on conjoint analysis warns that extrapolating the willingness to pay for an attribute beyond the range of prices presented to respondents generates "questionable" results, and should be avoided.⁶⁴ Going against this warning, Plaintiffs' experts rely on the results of a statistical model that extrapolates an estimate of "market value difference" far outside the range of conditions actually presented to the survey respondents.

45. While not as extreme as in the case of the 2 TB subscription prior to May 2017, the range of prices used in the Swain Survey also does not correspond to Dr. Swain's market simulation

⁶² For example, under Dr. Swain's assumptions, a consumer would be indifferent between receiving a discount of \$6 for the 2 TB product, or a discount of \$0.60 for the 50 GB product.

⁶³ See Mangum Report, Exhibit 10.

⁶⁴ Green, P. E., and V. Srinivasan (1978), "Conjoint Analysis in Consumer Research: Issues and Outlook," *Journal of Consumer Research*, 5, 2, 103–123., pp. 105–6 ("In practice, [part-worth] is estimated only for a selected set of levels [of attribute] (usually three or four), with the part worth for intermediate [levels of attribute] obtained by linear interpolation. Thus the part-worth function is represented as a piecewise linear curve. To determine the part worth for a value of [attribute], outside the range of estimation, extrapolation of the piecewise linear function would be needed and the validity of this procedure is questionable. (Hence, the researcher should try to employ the full range of the attribute, wherever practical.)").

analysis, or to Dr. Mangum's calculation of damages, for the 50 GB and 200 GB subscriptions, and for the 2 TB subscription after June 2017. While the prices shown to survey respondents for these products are at most 30% above or below the actual market price, Dr. Mangum performs his damages analysis assuming that prices in the but-for world would be 34.8% to more than 46.2% below the actual market prices,⁶⁵ well outside the range of prices that are offered to Dr. Swain's respondents for any particular storage size.

4. Dr. Swain's conjoint results are inconsistent with basic economic principles and are likely to overstate damages

46. Because Dr. Swain's analysis fails to account for supply-side factors, his conclusions are inconsistent with basic economic principles. For example, Dr. Swain's analysis generates estimates of but-for "market values" that are below Apple's cost. Dr. Swain claims that in the but-for world, Apple's prices would be 35% to 46% lower than in the actual world. [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] This fact underscores the unreliability of Dr. Swain's method.

47. Moreover, because Dr. Swain's estimates do not incorporate supply-side factors, they are likely to overstate damages alleged by Plaintiffs, if any exist. By design, Dr. Swain's survey can only obtain information regarding survey respondents' preferences for a hypothetical product or

⁶⁵ Mangum Report, Exhibit 8.

⁶⁶ APL-ICSTORAGE_00020688-703 at 702.

⁶⁷ See APL-ICSTORAGE_00019628-832 at 637 ([REDACTED] See also APL-ICSTORAGE_00019628-832 at 775 [REDACTED]

⁶⁸ [REDACTED] (see APL-ICSTORAGE_00019628-832 at 637), [REDACTED]

See APL-ICSTORAGE_00019628-832 at 802. [REDACTED]

See work papers.

product attributes,⁶⁹ not information from producers, which represents supply characteristics.⁷⁰ This means that Dr. Swain's economic loss estimates are at best a measure of the difference in the estimated WTP of his survey respondents when going from the "fully in-house" cloud storage attribute level to the "partly outsourced" cloud storage attribute level that he assumes would correct for Apple's alleged misrepresentation.

48. It is well understood, and Dr. Swain agrees,⁷¹ that WTP is *not* equivalent to the price offered or paid to purchase a good.⁷² Moreover, academic researchers warn that estimates based on WTP measures may overestimate the change in market price as a result of a change in one of the product characteristics:

In many cases, WTP will overstate the price premium afforded by feature enhancement....⁷³

The problem with the WTP and [willingness to buy] measures is that they are not equilibrium outcomes. WTP measures only a shift in the demand curve and not what the change in equilibrium price will be as the feature is added or enhanced.... Standard WTP measures are shown to greatly overstate the value of the product feature.⁷⁴

49. WTP will generally overestimate the change in market price, if any, due to the disputed language in the iCloud Terms and Conditions because it does not consider the reaction of suppliers. When faced with a downward shift in demand, a supplier, at a minimum, will have incentives to reduce the quantity offered to offset the potential change in price, as Dr. Mangum recognized in his report.⁷⁵ Because a reduction in the quantity offered causes market prices to rise, the net change in market prices will be, in general, smaller than the decline in WTP. Because Dr. Swain's results reflect only WTP at best, his estimates of reduction in value are very likely overstated.

⁶⁹ See Section VI.A.2

⁷⁰ Allenby et al. (2014), p. 630 ("Instead, a conjoint survey can be used to calibrate demand.... However, a conjoint survey, in and of itself, is not adequate to form the basis for equilibrium firm profit calculations.").

⁷¹ Swain Deposition, p. 125:5–6 ("A. Your willingness to pay isn't always the same of what someone would agree to sell it to you at").

⁷² Mankiw (2008), p. 138.

⁷³ Allenby et al. (2014), p. 649.

⁷⁴ Allenby et al. (2013), p. 342.

⁷⁵ Mangum Report, ¶ 50.

5. Dr. Swain mischaracterizes Dr. McFadden's explanation about the use of conjoint analysis in the estimation of market prices

50. Dr. Swain cites an article written by Nobel laureate Dr. Daniel McFadden (who developed a seminal approach to measure consumer preferences and market demand using conjoint analysis)⁷⁶ to support his claim that his “market-based method examines the difference, if any, in market value between two Apple’s iCloud offerings that are identical except for the Storage Location attribute level.”⁷⁷ However, Dr. Swain mischaracterizes Dr. McFadden’s opinions. Dr. McFadden does not claim that a method like Dr. Swain’s can estimate but-for market prices. Rather, he states that it cannot.

51. Dr. Swain states that according to Dr. McFadden “the difference in value is the same as the willingness to pay of the marginal consumer that can be identified by offering respondents a ‘None’ option in the conjoint survey.”⁷⁸ Dr. Swain seems to interpret Dr. McFadden’s opinion as providing support to the notion that Dr. Swain’s methodology, including his assumption that supply is “fixed as a matter of history” and his decision not to analyze supply-side factors, can yield a but-for market price estimate.⁷⁹ However, in publicly available documents, Dr. McFadden has clarified that his opinion in general, and as stated in the article cited by Dr. Swain, directly contradicts Dr. Swain’s interpretation. For example, in another legal matter in which an expert quoted the same article excerpt that Dr. Swain does here, for the same purpose, Dr. McFadden himself submitted an expert report and stated:

[An expert citing the same passage as Dr. Swain] failed to recognize that the admonition in my *Law360* article on the necessity of determining the WTP of the marginal consumer did not indicate that the marginal consumer could be determined without adequately analyzing and accounting for the supply side of the market. As explained above, calculating the market price differential in this matter (if any) requires an economically appropriate analysis of the supply side.⁸⁰

⁷⁶ McFadden, D. (1986), “The Choice Theory Approach to Market Research,” *Marketing Science*, 5, 4, 275–297.

⁷⁷ Swain Report, ¶ 85.

⁷⁸ Swain Report, ¶ 85.

⁷⁹ See Swain Report, ¶ 25.

⁸⁰ Expert Report of Professor Daniel McFadden on Behalf of Mondelez International, Inc., *Patrick McMorro, et al. v. Mondelez International, Inc.*, United States District Court for the Southern District of California, Case No. 3:17-cv-02327-BAS-JLB, October 30, 2019. (“McFadden Mondelez Report”), p. 19.

52. Similarly, Dr. McFadden clarified that one cannot calculate the but-for market price assuming that supply is fixed:

[Another expert citing the same statement as Dr. Swain] has misinterpreted my statement. One cannot determine a “but for” market equilibrium price under an unsound “but for” construct in which supply is held fixed as a matter of history.⁸¹

53. In fact, Dr. McFadden has expressed the opinion that conjoint analysis such as the one performed by Dr. Swain is insufficient to calculate the “marginal consumer” that Dr. Swain refers to in his report,⁸² and instead a complete economic analysis of supply-side factors is necessary to estimate but-for market prices:

[A] conjoint analysis on its own—no matter how well designed—cannot be used to determine the “marginal consumer.” As noted above, this is because the “marginal consumer” is the consumer whose valuation or WTP is exactly equal to the market equilibrium price, which can be determined only after an economic analysis of seller behavior and supply in the new world.⁸³

54. Dr. McFadden’s statement is consistent with my opinions in this report, and inconsistent with Dr. Swain’s position.

B. Dr. Mangum’s Economic Framework for Damages and His Assumption That Supply Is Fixed Contradict Dr. Swain’s Conclusions and Do Not Match Plaintiffs’ Theory of Harm

1. Dr. Mangum’s conclusions contradict Dr. Swain’s description of his “market value” measure and are inconsistent with Plaintiffs’ theory of harm

55. As an initial matter, the Mangum Report contains no analysis of either demand or supply-side factors—instead it presents Dr. Mangum’s arithmetic calculations of the total damages based upon Dr. Swain’s estimates.⁸⁴ The Mangum Report also presents Dr. Mangum’s

⁸¹ McFadden Mondelez Report, p. 20.

⁸² Swain Report, ¶ 85.

⁸³ Expert Report of Professor Daniel McFadden on Behalf of Polaris Industries, Inc., *Riley Johannessohn, et al. v. Polaris Industries Inc.*, United States District Court for the District of Minnesota, Case No. 0:16-cv-03348-NEB-LIB, January 31, 2019, ¶ 21.

⁸⁴ Mangum Report, Section IV.

descriptions and interpretations of the analysis and conclusions in the Swain Report.⁸⁵ These descriptions and interpretations make it clear that Dr. Swain's estimates of "market value difference" are not the market price premiums that Dr. Swain argues they are.

56. As explained in Section VI.A.2, Dr. Swain clearly views his estimate of "market value difference" as an estimated *change in market price*,⁸⁶ and relies on Dr. Mangum as the basis for his opinion that his methodology "accounts for appropriate supply-side factors" and accurately measures the change in market prices.⁸⁷ However, Dr. Mangum's description of the relevant measure of damages in this case, what he calls "economic value,"⁸⁸ makes it clear that Dr. Swain's estimates are not the difference between actual and but-for market prices, but instead are the changes in consumers' subjective willingness to pay, which is simply a demand-side factor.⁸⁹

57. When discussing damages based on "economic value," Dr. Mangum repeatedly points to changes in *demand*:

Assessing the reduction in economic value received by consumers *relates to demand* for selected features of iCloud as well as for the service overall.⁹⁰

[U]sers may not have been willing to pay what they agreed to pay in the real world for iCloud under the iCloud Terms and Conditions but *may have been willing to agree to a lower amount* based on the reduced economic value.⁹¹

...[A]ny reduction to value metrics *shifts the demand curve downward*.⁹²

Use of survey data is a recognized approach for *economic impact assessments, including analyzing the demand* for a particular feature of a product/service.⁹³

These statements indicate that Dr. Mangum's definition of Plaintiffs' alleged harm is the change in their willingness to pay for the iCloud Service.

⁸⁵ Mangum Report, Section IV.

⁸⁶ See, e.g., Swain Report, ¶ 23.

⁸⁷ Swain Report, ¶ 25.

⁸⁸ Mangum Report, ¶¶ 28–29.

⁸⁹ Again, willingness to pay is a demand-side measure, and is not equivalent to the price offered or paid to purchase a good. See, e.g., Swain Deposition, p. 125:5–6 ("A. Your willingness to pay isn't always the same of what someone would agree to sell it to you at").

⁹⁰ Mangum Report, ¶ 30 (emphasis added).

⁹¹ Mangum Report, ¶ 30 (emphasis added).

⁹² Mangum Report, ¶ 31 (emphasis added).

⁹³ Mangum Report, ¶ 33 (emphasis added).

58. There is no ambiguity as to whether Dr. Mangum’s definition of “economic value” is consistent with the definition of market price; it is not. In fact, Dr. Mangum claims (incorrectly) that “...the damages theory [in this case] does not require reconstructing a market equilibrium, but rather identifying the difference in the economic value...”⁹⁴

59. Dr. Mangum contradicts Dr. Swain’s claims because Dr. Mangum’s analysis concludes that Dr. Swain does not measure a market price, but instead measures consumers’ “economic value” (i.e., consumers’ willingness to pay). For example, Dr. Mangum states “...Professor Swain has measured the reduction in *economic value* of iCloud subscriptions for class members assuming a representation from Apple regarding outsourcing the data storage.”⁹⁵

60. Dr. Mangum not only contradicts Dr. Swain’s conclusions, but his economic framework for damages in this case is inconsistent with Plaintiffs’ theory of harm. Plaintiffs allege that putative class members would have paid a lower market price for the iCloud Service.⁹⁶ However, Dr. Mangum argues that “consumers are damaged based on the reduction of *economic value*.”⁹⁷ While Plaintiffs’ overpayment theory requires the calculation of the market prices that consumers would have paid in the but-for world absent the alleged wrongful conduct (the “but-for price”), Dr. Mangum instead claims that the market price in the but-for world is not relevant.⁹⁸

2. Holding supply constant is inappropriate and it is not tantamount to accounting for supply-side factors in the but-for world

61. Dr. Mangum claims that “[t]he supply in [his] damages framework is the historical quantity of class members’ paid subscriptions for iCloud during the Class Period.”⁹⁹ Similarly, Dr. Swain assumes that Apple would sell the same number of paid subscriptions in the but-for world as it did in the actual world.¹⁰⁰ These assumptions are inconsistent with Plaintiffs’ theory

⁹⁴ Mangum Report, ¶ 50.

⁹⁵ Mangum Report, ¶ 43 (emphasis added).

⁹⁶ See, e.g., First Amended Complaint, ¶ 40.

⁹⁷ Mangum Report, ¶ 28 (emphasis added).

⁹⁸ Mangum Report, ¶ 50.

⁹⁹ Mangum Report, ¶ 48.

¹⁰⁰ Swain Report, ¶ 25.

of harm because they fail to account for supply-side factors that would be present in the but-for world and would contribute to the determination of but-for prices.

62. Dr. Mangum and Dr. Swain's assumption that supply in the but-for world is fixed at the quantity sold in the actual world is equivalent to assuming that Apple would sell a fixed number of subscriptions to the iCloud Service no matter what the price. This is an extreme characterization of Apple's supply, inconsistent with real-world Apple data,¹⁰¹ and Plaintiffs have offered no reason to believe this would be the case in the but-for world in which the challenged language is removed. Assuming that the quantity is fixed in the but-for world ignores that Apple may find it optimal to reduce the supplied quantity in the but-for world, and would result in an estimate of but-for price that could never occur in the real market because Apple would not be willing to sell the same quantity at the lower but-for price. The change in "market value" calculated by Dr. Swain can occur only in a scenario where Apple would be *forced to sell* the same number of units in the but-for world as it did in the actual world.

63. Dr. Mangum acknowledges that in the but-for world, absent the alleged wrongdoing, supply may be lower than in the actual world.¹⁰² However, he argues that calculating the appropriate market equilibrium in the but-for world "runs the risk of understating damages and failing to account for harm associated with subscriptions that would not occur in the reconstructed market."¹⁰³ Dr. Mangum's argument for ignoring supply-side factors is misguided.¹⁰⁴

64. Dr. Mangum's economic framework ignores that there are two components to the calculation of market price-based damages. One is the calculation of the number of paid iCloud Service subscriptions eligible for damages, and the other is the calculation of the "price premium" (the difference between actual and but-for market prices). While Plaintiffs may argue that damages should be based on a price premium that is applied to the number of iCloud Service subscriptions bought in the actual world, it is incorrect to argue that the but-for price must be determined under the constraint that the number of subscriptions bought in the but-for world

¹⁰¹ As explained in Section VII.A, throughout the Damages Class Period [REDACTED]

¹⁰² Mangum Report, footnote 67 ("Under a reconstructed market equilibrium, iCloud prices and quantities may be reduced...").

¹⁰³ Mangum Report, ¶ 50.

¹⁰⁴ Dr. Swain does not provide any support for his assumption other than his conversations with Dr. Mangum.

(i.e., the but-for quantity) matches the number of subscriptions in the actual world (i.e., actual quantity).

65. One of the academic references cited by Dr. Mangum, the *Reference Manual on Scientific Evidence*, notes that the analysis of damages “considers the difference between the plaintiff’s economic position if the harmful event had not occurred and the plaintiff’s actual economic position.”¹⁰⁵ The assessment of the economic position of Plaintiffs means modeling, in the hypothetical but-for world, how consumers *and suppliers* would respond to the correction of the harmful act and, ultimately, how the market price of iCloud products would change going from the actual world to the but-for world.¹⁰⁶ There is no economic justification for allowing consumers, but not suppliers, to react to the removal of the challenged conduct in the but-for world.

66. Dr. Mangum restricts the characterization of the but-for world solely to the type of information consumers have about the iCloud Service and the resulting change in consumer preferences. While Dr. Mangum argues for the use of conjoint analysis to measure changes in consumer preferences and actions that stem directly from the correction of the harmful act in the but-for world, he maintains that measuring and incorporating any actions on the part of suppliers that stem directly from the correction of the harmful act (which he admits are possible¹⁰⁷) would not be appropriate.

67. Basic microeconomic theory describes market outcomes, such as market prices, as the result of both producers and consumers taking actions to maximize their economic value.¹⁰⁸ Thus, allowing suppliers to react to the correction of the harmful act in the but-for world is not only part of what the *Reference Manual on Scientific Evidence* calls assessing Plaintiffs’ “economic position,”¹⁰⁹ but also is necessary to arrive at reliable but-for market prices of the iCloud Service. Again, market prices are determined by both demand and supply. Once a proper but-for world is constructed and the but-for market price has been reliably modeled

¹⁰⁵ Allen, M. A., R. E. Hall, and V. A. Lazear (2011), “Reference Guide on Estimation of Economic Damages,” in *Reference Manual on Scientific Evidence*, 3rd ed., Washington, DC: The National Academies Press, 425–502 at 432.

¹⁰⁶ The Mangum Report explains that “[u]nder a reconstructed market equilibrium, iCloud prices and quantities may be reduced...” See Mangum Report, ¶ 50.

¹⁰⁷ Mangum Report, footnote 67.

¹⁰⁸ See, e.g., Mankiw (2008), p. 77.

¹⁰⁹ Allen, M. A., R. E. Hall, and V. A. Lazear (2011), “Reference Guide on Estimation of Economic Damages,” in *Reference Manual on Scientific Evidence*, 3rd ed., Washington, DC: The National Academies Press, 425–502 at 432.

incorporating both demand and supply factors, it then becomes possible to calculate consumer overpayment (if any) for members of the Damages Class. By refusing to allow suppliers to react in his but-for world, for example by reducing the quantity supplied, Dr. Swain's resulting price calculations do not represent market prices in the but-for world and therefore cannot be used to determine any consumer overpayment, which is the difference in market prices between the actual and but-for worlds.

VII. Actual Market Data Are Inconsistent with Plaintiffs' Allegations and Show That Dr. Swain's Conjoint Is Unreliable Because It Generates Results That Are Divorced from Reality

68. Plaintiffs claim that iCloud users "would either not have subscribed to Apple's iCloud or would not have agreed to pay Apple as much as they did for their iCloud subscription" had Apple disclosed that it was using both Apple and third-party servers to store iCloud user data.¹¹⁰ However, data from actual decisions of users of the iCloud Service and other cloud storage providers are inconsistent with Plaintiffs' allegations and with the results of Dr. Swain's conjoint analysis. Specifically, the behavior of the named Plaintiffs shows that they were willing to pay the same iCloud prices even after learning about Apple's storage practices. Similarly, data from iCloud users and data from Dropbox are inconsistent with Plaintiffs' allegations and with the predictions generated by Dr. Swain's conjoint analysis. The disconnect between actual market data and the results of Dr. Swain's conjoint analysis demonstrates that the conclusions that Dr. Swain obtains from his analysis are unreliable.

A. The Behavior of the Named Plaintiffs Is Inconsistent with Plaintiffs' Allegations

69. The behavior of Plaintiffs Andrea Williams and James Stewart is inconsistent with the claim that they would either not have subscribed or would not have agreed to pay what they did for the iCloud Service. Neither Ms. Williams nor Mr. Stewart cancelled their subscription to the iCloud Service, and they continued to pay the market price offered by Apple even after learning that Apple could store part of their data on third-party servers.¹¹¹ Moreover, Ms. Williams

¹¹⁰ First Amended Complaint, ¶ 65.

¹¹¹ Deposition of Andrea M. Williams, December 18, 2020 ("Williams Deposition"), p. 97:2-4 ("Q. And you've continued to pay for your iCloud subscription from then until now. Correct? A. Yes."); Deposition of James Stewart,

clarified that to this date she has not changed any of the choices she had made with respect to her Apple device and the iCloud Service.¹¹²

70. While Plaintiffs have asserted that the implicit and explicit costs of cancelling their iCloud Service subscription, commonly known as “switching costs,”¹¹³ are important to their decisions regarding their ongoing purchase of the Service,¹¹⁴ neither Dr. Swain nor Dr. Mangum provides any analysis (or even any mention) of switching costs in their reports. For example, Dr. Swain’s and Dr. Mangum’s analyses do not consider that existing iCloud Service users (including 87% of Dr. Swain’s sample¹¹⁵) may prefer to continue using the Service because of the set of benefits and efficiencies that they obtain from staying within the Apple “ecosystem.” The iCloud Service allows users to do much more than just store data. For example, it allows them to make more efficient use of their device’s built-in memory; to comprehensively back up their Apple device; to automatically sync content across their Apple devices; to keep mail, contacts, calendar, notes, and reminders up to date; to use Apple’s “Find My iPhone” feature; to collaborate with various Apple apps; and to use Apple’s password management features, among many other benefits.¹¹⁶ Ms. Williams stated that she uses Backup, Photo Library, and Keychain as part of her use of the iCloud Service.¹¹⁷ She said that “ultimately [she] want[s] to keep all of [her] things in the same place.”¹¹⁸ Mr. Stewart said that he uses Backup and Photo Sharing,¹¹⁹ and that he uses the iCloud Service to sync contacts, calendars, notes, reminders, bookmarks, and

December 15, 2020 (“Stewart Deposition”), p. 129:6–9 (“Q And is there any type of data that you’ve stopped storing on iCloud since you’ve become aware that Apple uses third-party servers? A. No.”).

¹¹² Williams Deposition, p. 97:17–20 (“Q. Have you considered using another Cloud storage Service? A. No. I haven’t changed anything about the things that come with my Apple phone”).

¹¹³ Switching costs are the changeover costs of switching from a product to one of its substitutes. High switching costs can cause consumers to have more “inelastic” demands (i.e., consumers are less sensitive to changes in price), and can lead to higher prices set by the firms in the market. See Klemperer, P. (1987), “The Competitiveness of Markets with Switching Costs,” *RAND Journal of Economics*, 18, 1, 138–150 at 138.

¹¹⁴ Williams Deposition, p. 101:6–15.

¹¹⁵ Swain Report, ¶ 30.

¹¹⁶ See, e.g., “What Is iCloud?” Apple, <https://support.apple.com/guide/icloud/what-is-icloud-mm74e822f6de/icloud>.

¹¹⁷ Williams Deposition, p. 83:16–23 (“Q. Do you back up your calendar using iCloud? A. Like I stated earlier, I do have a backup scheduled. It’s usually once a week. It’s not that I go in and actually do it. It just happens. Q. And are you syncing your entire device? A. Yeah. I -- yeah. Yeah. I mean, I don’t opt out. I don’t pick and choose. It’s just, you know, back up, back up”); Williams Deposition, p. 40:12–16 (“Q. Are you aware of the iCloud feature the iCloud Photo Library? A. Yes. That’s where I look at all my pictures when I pull up -- pull it up on my phone so I could pick one. Yes.”); Williams Deposition, p. 42:11–18 (“Q. Are you familiar with the iCloud feature iCloud Keychain? A. Keychain. Is that the passwords? ... That’s the passwords? Yes. I’ve started using that. I can’t tell you exactly how to use it, but I’ve managed to save some passwords in there, and they come back when I ask for them”).

¹¹⁸ Williams Deposition, p. 101:11–13 (“Again, as I said earlier, ultimately I want to keep all of my things in the same place. Would I go and look for -- no”).

¹¹⁹ Stewart Deposition, p. 134:20–25 (“Q Have you set up any sort of automatic backup on iCloud? A I have, yes. Q And what data is automatically backed up to iCloud, if you know? A All the data that’s on my phone”); Stewart Deposition, p. 132:8–10 (“Q Do you share photos with other iCloud users through iCloud? A Sometimes, yes”).

tabs across devices.¹²⁰ Mr. Stewart also explained that the iCloud Service is (at least partly) a reason why he has continued to use Apple products.¹²¹

71. [REDACTED]

[REDACTED] Consistent with this, Ms. Williams stated she was “thrilled” with the iCloud Service.¹²³ Similarly, Dr. Scott finds that iCloud subscribers show high satisfaction with the iCloud Service, and more iCloud subscribers rate the service highly compared to alternatives such as Google Cloud and Microsoft OneDrive.¹²⁴ The efficiencies and benefits that Apple ecosystem users obtain from iCloud make it less likely for consumers to use a different storage provider even if Apple were to disclose partly-outsourced storage.

B. Plaintiffs’ Allegations Are Inconsistent with Real-World Market Data from Apple

72. A large, uniform, class-wide injury due to the statement in the iCloud Terms and Conditions that content is “sent to and stored by Apple” is inconsistent with the actual behavior of iCloud Service users following the publication of information about Apple’s storage practices (including the fact that iCloud Service data storage was being outsourced at least partly). Over the Damages Class Period, news articles, industry publications, and specialized articles explicitly discussed the outsourcing of iCloud’s data storage. For example, on March 16 and 17, 2016, public news sources reported that Apple was storing some of its users’ iCloud Service data on Google’s computer servers.¹²⁵ The public press coverage on this event includes the *Wall Street*

¹²⁰ Stewart Deposition, p. 131:2–16 (“Q Do you currently use iCloud to sync your contacts across devices? A Yes. Q Do you currently use iCloud to sync calendars across devices? A Yes. Q Do you currently use iCloud to sync notes across devices? A Yes. Q Do you currently use iCloud to sync reminders across devices? A Yes. Q Do you currently use iCloud to sync bookmarks and tabs? A Yes”).

¹²¹ Stewart Deposition p. 25:20–24 (“Q Do you consider iCloud in making your decision to stick with Apple devices? Is iCloud a consideration? A It is and not because iCloud is a service that provides something that I do need.”).

¹²² Specifically, in 2017, [REDACTED]

See APL-ICSTORAGE_00036105–87 at 44.

¹²³ Williams Deposition, p. 85:8–11 (“Q. How happy have you been with iCloud? A. Thrilled. Q. Were you celebrating there? A. I was celebrating”).

¹²⁴ Scott Report, ¶¶ 55–56.

¹²⁵ See, e.g., “Apple Signs Up to Google Cloud Services,” *Financial Times*, March 16, 2016, <https://www.ft.com/content/d5d3d5fc-ebc9-11e5-bb79-2303682345c8>; “Google Just Scored a Huge Win Against Amazon by Landing Apple as a Customer,” *Business Insider*, March 16, 2016, <https://www.businessinsider.com/google-nabs-apple-as-a-cloud-customer-2016-3>; “Apple iCloud Might Run on Google’s Servers,” *Medium*, March 16, 2016, <https://medium.com/chip-monks/apple-icloud-might-run-on-googles->

Journal reporting that “Apple Inc. [was] moving some of its data to Google’s computing-on-demand service from Amazon.com Inc.’s,”¹²⁶ and the *Financial Times* reporting that “Apple [had] moved some of its iCloud services on to the Google Cloud....”¹²⁷ This event provides a “natural experiment” that is informative about how some consumers behaved during the Damages Class Period upon receiving information that their data storage was partly outsourced. If Plaintiffs’ allegations were correct, one would expect to observe evidence of changes in consumer behavior after users received new information about Apple’s storage practices.

73. In fact, Apple’s prices and user growth did not decline after the release of the articles on March 16 and 17, 2016. Figure 2 shows Apple’s monthly prices during the Damages Class Period for the 50 GB, 200 GB, and 2 TB products. Prices for the 50 GB and 200 GB Service subscriptions remained constant after March 2016 until the end of the Damages Class Period, while the price of the 2 TB product did not decline until more than a year after the articles’ publishing date.¹²⁸

servers-15fe1859548d; “Apple Using Google’s Cloud, Moving Some Data from Amazon,” *The Wall Street Journal*, March 17, 2016, <https://www.wsj.com/articles/apple-using-googles-cloud-moving-some-data-from-amazon-1458239465>; “Apple Stores iCloud Data with Google,” *BBC News*, March 17, 2016, <https://www.bbc.com/news/technology-35837692>.

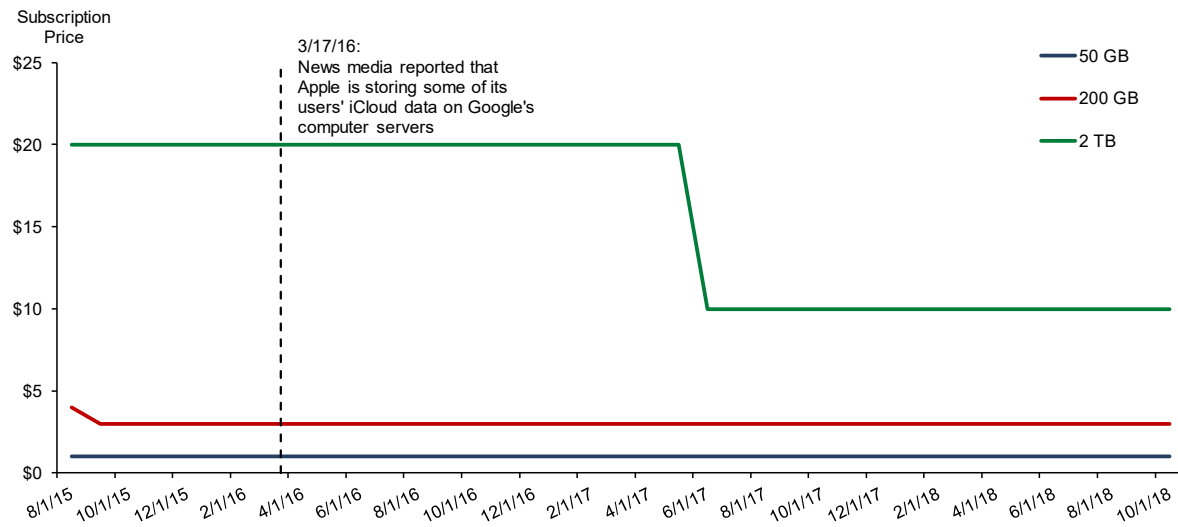
¹²⁶ “Apple Using Google’s Cloud, Moving Some Data from Amazon,” *The Wall Street Journal*, March 17, 2016, <https://www.wsj.com/articles/apple-using-googles-cloud-moving-some-data-from-amazon-1458239465>.

¹²⁷ “Apple Signs Up to Google Cloud Services,” *Financial Times*, March 16, 2016, <https://www.ft.com/content/d5d3d5fc-ebc9-11e5-bb79-2303682345c8>.

¹²⁸ On or around June 5, 2017, Apple announced that it had upgraded existing 1 TB subscriptions to 2 TB, while maintaining the price of \$9.99 paid by 1 TB users, and that new 2 TB subscriptions would be priced at \$9.99. See “iCloud Storage Plans and Pricing,” *Apple*, June 6, 2015, <https://web.archive.org/web/20170606145307/http://support.apple.com/en-us/HT201238>.

Figure 2: iCloud Subscription Prices

8/1/15 – 10/1/18

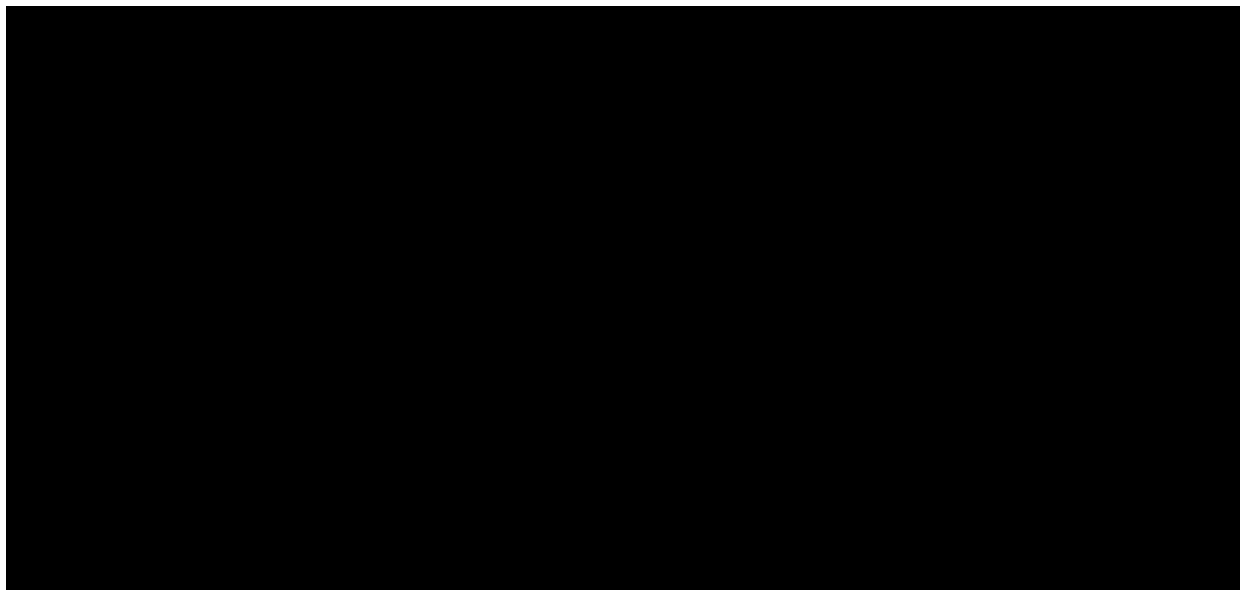


Source: Mungum Report and production materials; “Apple Stores iCloud Data with Google,” *BBC News*, March 17, 2016, <https://www.bbc.com/news/technology-35837692>

74.

████████████████████ This evidence is inconsistent with Plaintiffs’ claim that a change in the disputed language would negatively affect consumer behavior.

¹²⁹ APL-ICSTORAGE 00019628–832 at 726.

Figure 3: iCloud Paid Users Monthly Growth Rate

Source: APL-ICSTORAGE_00041180.xlsx; "Apple Stores iCloud Data with Google," *BBC News*, March 17, 2016, <https://www.bbc.com/news/technology-35837692>

Note:

[1] Paid user data for iCloud are available from August 2015.

75. The natural experiment created by the news published on March 16 and 17, 2016, is only one of many examples of news media reporting information about Apple's storage practices during the Damages Class Period. Simple internet searches yield many articles discussing Apple's use of third-party vendors' servers.¹³⁰ The stability in the iCloud Service's prices and in the growth of the Service's paid user base during a period where information about iCloud Service's storage practices was available to the public appears to contradict Plaintiffs' claim that iCloud Service users would not have agreed to pay as much as they did for their iCloud Service subscription had they learned that Apple used third-party servers to store their data. Even if just

¹³⁰ See, e.g., "Apple Is 1/10th of Amazon AWS Revenue: What If It Stops Buying?" *Benzinga*, February 1, 2016, <https://www.benzinga.com/analyst-ratings/analyst-color/16/02/6192918/apple-is-110th-of-amazon-aws-revenue-what-if-it-stops-bu>; "Cloud Makes for Strange Bedfellows: Apple Signs on with Google, Cuts Spending with AWS," *CRN*, March 16, 2016, <https://www.crn.com/news/cloud/300080062/cloud-makes-for-strange-bedfellows-apple-signs-on-with-google-cuts-spending-with-aws.htm>; "Apple Reportedly Working with Chinese Server Vendor to Help Bring Cloud Services In-House," *9to5Mac*, April 11, 2016, <https://9to5mac.com/2016/04/11/apple-icloud-in-house-inspur/>; "Human Error Caused Amazon Web Services Outage, Apple iCloud Service Issues," *AppleInsider*, March 2, 2017, <https://appleinsider.com/articles/17/03/02/human-error-caused-amazon-web-services-outage-apple-icloud-service-issues>; "Apple Confirms It Uses Google's Cloud for iCloud," *CNBC*, February 26, 2018, <https://www.cnn.com/2018/02/26/apple-confirms-it-uses-google-cloud-for-icloud.html>; "How to Find Out Where Apple Stores Your iCloud Data (Spoiler: You Can't Exactly)," *Macworld*, May 22, 2018, <https://www.macworld.com/article/3274584/where-does-apple-stores-your-icloud-data.html>.

a subset—of a sufficient size—of prospective iCloud Service users had changed their behavior due to the disclosure, one would expect to see an effect on quantity or market price, but none is observed in the data. The lack of any apparent price or quantity reaction following public reports of Apple’s use of partly outsourced storage would suggest (1) that consumers were aware of that information so that any additional disclosure would have limited effect, or (2) that their preferences were such that the knowledge of the use of partly outsourced storage did not have a sufficient effect on their utility to change their product choice. Either explanation is inconsistent with Dr. Swain’s prediction of a large shift in demand for iCloud services upon the removal of the disputed language.

C. The Predictions of Dr. Swain’s Conjoint Model Are Inconsistent with Real-World Market Data from Apple

76. In addition to showing that the behavior of iCloud Service users is inconsistent with Plaintiffs’ allegations, Apple’s real-world market data demonstrate that Dr. Swain’s conjoint analysis is flawed and unreliable.

77. An important test of the validity and reliability of economic analysis (including conjoint analysis) is whether it can accurately model the behavior of consumers in the marketplace. This type of test, known as “external validity,” evaluates whether a study or set of studies can be used to reach general conclusions about the behavior of a large group of consumers, and not just about the participants of the study.¹³¹ For example, as explained in a book cited by Dr. Swain, “[t]rue validity tests usually require real-world sales or choice data rather than hold-out conjoint questions asked during the same survey as the other conjoint tasks.”¹³² For a conjoint analysis such as the one proposed by Dr. Swain, a possible test of external validity would measure “[t]he ability of a conjoint analysis model or market simulator to accurately predict some outcome outside of the realm of the survey, such as a subsequent choice or purchase by an individual, or market shares for a population.”¹³³ Critically, a study with no external validity is unreliable

¹³¹ Kaye, D. H., and D. A. Freedman (2011), “Reference Guide on Statistics,” in *Reference Manual on Scientific Evidence*, 3rd ed., Washington, DC: The National Academies Press (“Reference Guide on Statistics”), 211–302 at 301.

¹³² Orme, B. K. (2014), *Getting Started with Conjoint Analysis: Strategies for Product Design and Pricing Research*, 3rd ed., Manhattan Beach, CA: Research Publishers LLC (“Orme (2014)”), p. 190.

¹³³ Orme (2014), p. 184.

because it cannot be generalized to conditions beyond the particular circumstances of the study.¹³⁴

78. A comparison of real-world Apple data to results obtained using Dr. Swain's conjoint analysis shows that his analysis has no external validity, and therefore its results cannot be extended from Dr. Swain's survey context to make inferences about the behavior of class members generally in the but-for world. As noted previously and shown in Figures 2 and 3, Dr. Swain's prediction of a 34.8% or more decline in but-for market price is inconsistent with observed market data which shows generally stable prices and growing quantities even when consumers have information about the use of outsourced storage.¹³⁵

79. To further demonstrate the mismatch between the predictions of Dr. Swain's conjoint survey and the behavior of consumers in the actual market, it is possible to predict certain observable market outcomes using Dr. Swain's methodology and to compare these outcomes to market data.

80. First, it is possible to compare the market shares of two products with the same attributes except "storage location" while holding prices constant. In Dr. Swain's framework, this calculation is equivalent to a prediction of what consumers would do after learning that a paid iCloud Service subscription did not actually feature "in-house" storage, but instead it featured "partly outsourced" storage, while Apple maintained the price of the service constant. Figure 4 shows the results of this prediction for each of three storage sizes for iCloud products.

¹³⁴ "Reference Guide on Statistics," 211–302 at 301.

¹³⁵ Price changes for cloud storage are relatively rare, and the prices from other storage providers have been generally the same or lower than iCloud prices. For example, Google Drive has maintained the price of \$1.99 for 100 GB of storage from 2014 to 2021. See "Save More with Google Drive," *Google*, March 13, 2014 <https://blog.google/products/drive/save-more-with-google-drive/>; "Upgrade to a Plan that Works for You," *Google*, <https://one.google.com/about/plans>, accessed on January 29, 2021. See also Mangum Report, Exhibits 5, 6, and 7.

**Figure 4: Market Shares for iCloud Products
Predicted Using Dr. Swain’s Methodology**

Storage Tier	Fully In-House	Partly Outsourced	Change in Market Share
50 GB	56.9%	31.1%	-45%
200 GB	57.5%	31.4%	-45%
2 TB	40.0%	22.8%	-43%

Source: Swain Report and production materials; Mangum Report; APL-ICSTORAGE_00041180 at tab (ii)

Note:

[1] Market shares are calculated using Swain’s main effect model in a simulation that considers two iCloud products with identical features except for Storage Location, and the “none” option. The prices of the products are \$0.99 for the 50 GB products, \$2.99 for the 200 GB products, and \$9.99 for the 2 TB products.

81. As shown in Figure 4, Dr. Swain’s methodology predicts a decline in market share between 43% and 45% when changing the storage location attribute from “in-house” to “partly outsourced.” [REDACTED]

[REDACTED] The large disconnect between the predictions generated using Dr. Swain’s estimates of consumer preferences and the actual data for iCloud subscriptions over the Damages Class Period demonstrates the lack of external validity of Dr. Swain’s conjoint analysis, and suggests that any conclusions derived from it are unreliable.

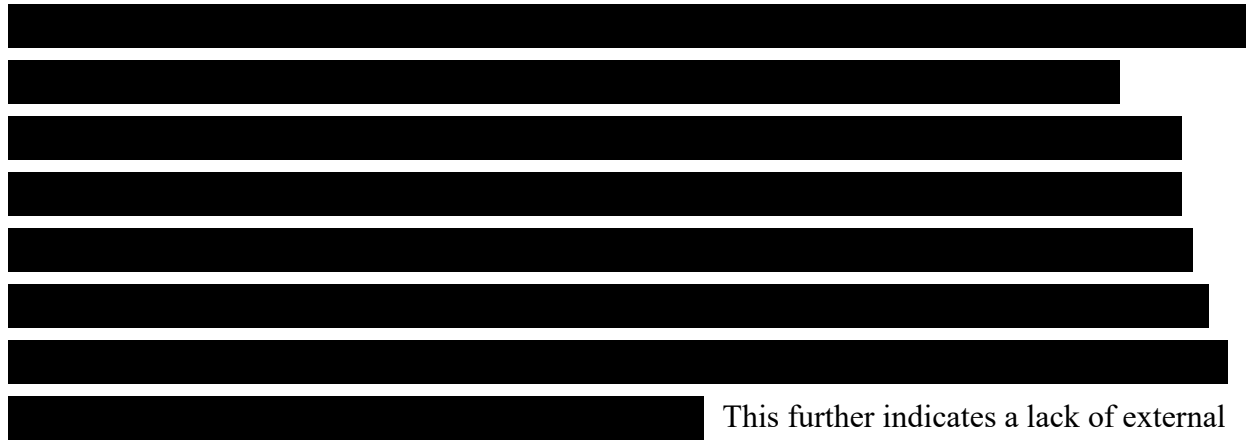
82. Second, it is possible to test whether Dr. Swain’s conjoint analysis is capable of replicating the pattern of demand for different iCloud products in the actual world by looking at the predicted relative market shares of different iCloud products under prevailing market conditions and comparing them to the observed relative market shares of different iCloud products.¹³⁷ Dr. Swain acknowledges that this comparison is a typical test of the external validity

¹³⁶ I also note that between [REDACTED] outpacing the growth of iPhone users in the United States, which was only 24%. See “Number of iPhone users in the United States from 2012 to 2021,” *Statista*, 2021, <https://www.statista.com/statistics/232790/forecast-of-apple-users-in-the-us/> (citing numbers from eMarketer.com); APL-ICSTORAGE_00041180.

¹³⁷ The term “market share” is used for simplicity to refer to the results of Dr. Swain’s simulations. However, these figures do not represent actual market shares, but instead the predicted share of the preferences of consumers facing the options considered in the simulation at the prices used in the simulation.

of a conjoint analysis.¹³⁸ Figure 5 shows a comparison of the predicted market shares for the 50 GB, 200 GB, and 2 TB iCloud products, and the actual market shares calculated using iCloud paid user data from the twelve-month period prior to the end of the Damages Class Period. To account for the options available to consumers in the real world that are not available in Dr. Swain's simulation framework, the actual and predicted shares are normalized by the corresponding share of the 50 GB service (i.e., the 50 GB share is set at 100% and the market shares for the other storage sizes are relative to that 100%). This way, the results of Dr. Swain's simulation do not depend on the competing services included (or not included) in the simulation.

83. [REDACTED]



This further indicates a lack of external validity of Dr. Swain's conjoint model.

Figure 5: External Validity Test of Dr. Swain's Conjoint Analysis

iCloud Products	Proportion of Paid Users Relative to the 50 GB iCloud Product		Difference
		Predicted Using Dr. Swain's	
	Actual ^[1]	Methodology ^[2]	

Source: APL-ICSTORAGE_00041180 at tab (ii); Swain Report production materials

Note:

¹³⁸ Swain Deposition, p. 158:10–15 (“[G]enerally when people are talking about external validity in a conjoint, they are looking at, you know, having some external source of information about market shares under different situations and whether the conjoint study is consistent with this”).

[1] Calculated as the percentage of market share of the 200 GB and 2 TB iCloud products over the market share of the 50 GB iCloud product. Market shares are calculated as the average market share for each storage tier and each month from November 2017 to October 2018.

[2] Calculated as the percentage of simulated market shares for the 200 GB and 2 TB iCloud products divided by the simulated market share for the 50 GB iCloud product using Dr. Swain's main effect model. Simulation uses the prices \$0.99, \$2.99, and \$9.99 for the 50 GB, 200 GB, and 2 TB iCloud products respectively, and the attributes "Fully in-house" for Storage Location, "iOS, Mac, or PC" for Multi-device Sync, and "1-6 users" for Family Share.

D. Plaintiffs' Allegations, as Well as the Predictions of Dr. Swain's Conjoint Model, Are Inconsistent with Real-World Market Data from Dropbox

84. Evidence from Dropbox's performance over the Damages Class Period is inconsistent with Plaintiffs' claim that "users have an interest in who is offering this storage and taking custody of their data."¹³⁹ In March 2016, Dropbox announced that it was moving its storage capabilities in-house and that it had achieved the milestone of 90% of in-house storage, from a fully outsourced storage approach three years before the announcement.¹⁴⁰ This announcement provides a second "natural experiment" that is informative about how consumers behaved upon receiving information about Dropbox's storage practices (specifically that Dropbox had switched from fully outsourced storage to over 90% in-house). If indeed consumers had strong preferences for where their data are stored, then it would be reasonable to expect that both Dropbox prices and the growth in its subscription revenue would have reacted positively to Dropbox's announcement in March 2016. However, data from the company do not seem to indicate such reaction.

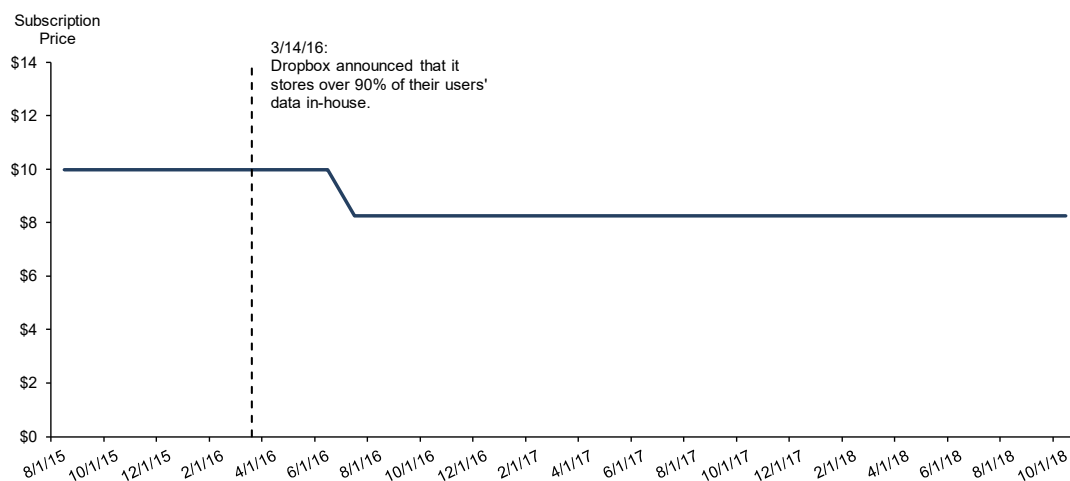
85. Dropbox's prices and revenue growth did not significantly increase after the announcement in March 2016. Figure 6 shows Dropbox's monthly price during the Damages Class Period for its 1 TB product. The price did not change for months after its announcement, and when it did change, it decreased.

¹³⁹ First Amended Complaint, ¶ 3.

¹⁴⁰ "Scaling to Exabytes and Beyond," *Dropbox*, March 14, 2016, <https://dropbox.tech/infrastructure/magic-pocket-infrastructure>.

Figure 6: Dropbox 1 TB Subscription Prices

8/1/15 – 10/1/18



Source: Mangum Report and production materials; “Scaling to Exabytes and Beyond,” *Dropbox*, <https://dropbox.tech/infrastructure/magic-pocket-infrastructure>

86. Similarly, there was no apparent change in the pattern of Dropbox’s subscription revenue growth around the time of Dropbox’s announcement, based on its reported data.¹⁴¹ Its revenue was growing prior to the March 2016 announcement and continued to grow at approximately the same rate after the announcement, indicating that there was no significant jump in the number of subscribers.

87. Thus, the stability in Dropbox’s prices and in the growth of subscription revenue is inconsistent with Plaintiffs’ claim that users have strong preferences with respect to whether their data is stored in-house or the location is partly outsourced.

VIII. Dr. Swain’s Conjoint Analysis Ignores Consumer Heterogeneity and Generates Irrational Preferences

88. Dr. Swain’s conjoint analysis ignores significant heterogeneity in preferences, switching costs, and information across putative class members that render his study irrelevant for measuring the alleged damages. Once this heterogeneity is considered, Dr. Swain’s results reveal that the majority of his respondents do not have a preference between in-house storage

¹⁴¹ On its form S-1, Dropbox reported “monthly subscription amount by quarterly cohort.” See Dropbox, Inc., SEC Form S-1, filed February 23, 2018. Dropbox further explained, “[f]or paying users who opt for our monthly plans, the monthly subscription amount is equal to the price of the monthly plan. For paying users who opt for our annual plans, which a majority of our users do, the monthly subscription amount is equal to the price of the annual plan divided by twelve.” See Dropbox, Inc., SEC Form S-1, filed February 23, 2018.

and partly outsourced storage. Because of heterogeneity in consumer preferences, in switching costs, and in information across iCloud Service users, there is no reason to believe that a change in iCloud's Terms and Conditions would have exactly the same effect across a large group of consumers purchasing different products over many years. Moreover, likely as a result of the multiple flaws in the Swain Survey, Dr. Swain's analysis generates estimates of consumer preferences that are inconsistent with rational consumer behavior, which suggests that his analysis and results are unreliable.

A. Dr. Swain Ignores Significant Heterogeneity in the Putative Damages Class

89. If iCloud users are not similarly situated, it is inappropriate to claim that they were affected in the same way by the disputed language and that damages for the Damages Class can be calculated using a common method. Specifically, if there are systematic differences in the preferences, costs, and information of iCloud Service users, it is inappropriate for Dr. Swain to calculate a "market value difference" for buyers of the same product without explicitly taking into account those systematic differences. Dr. Swain's conjoint analysis ignores heterogeneity in preferences, costs, and information in the market for cloud storage services that indicates that the economic factors affecting demand and supply differ across products, consumers, and time.

1. Dr. Swain ignores heterogeneity in consumer preferences

90. Dr. Swain ignores the fact that there is large variation in how and why consumers use the iCloud Service. For example, Plaintiff Mr. Stewart explained that he uses the Service primarily because of its "seamless access."¹⁴² His wife, on the other hand, uses it to upload photos occasionally.¹⁴³ Plaintiff Ms. Williams upgraded to a paid iCloud Service subscription because she wanted to maintain all her information in the same storage service.¹⁴⁴ According to Dr. Scott, iCloud purchasers cite many reasons for purchasing an iCloud Service subscription. She finds that iCloud's ease of use and iPhone backup capabilities are some of the most important reasons

¹⁴² Stewart Deposition, p. 25:23–25 ("...iCloud is a service that provides something that I do need. I need storage. I need seamless access").

¹⁴³ Stewart Deposition, p. 121:13–15 ("And her situation is different because she rarely uses it as I use it. So she doesn't – it's more photos for her, you know.").

¹⁴⁴ Williams Deposition, p. 39:2–5 ("No, because I'd already had the Cloud that I was not paying for. And I was putting stuff in it. So, to me, it made sense to keep it in the same place. So I paid for additional Apple storage").

for purchasing an iCloud Service subscription.¹⁴⁵ [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

91. Consumers may also vary in their preferences for various non-storage features of the Service and the benefits they obtain from the Apple ecosystem. For example, Ms. Williams uses family sharing while Mr. Stewart does not.¹⁴⁸ Similarly, Mr. Stewart uses “Find My iPhone” and syncing across devices while Ms. Williams does not.¹⁴⁹ Dr. Scott’s survey shows that there is variation in respondents’ use of different iCloud Service features, such as backing up content and syncing across devices.¹⁵⁰ [REDACTED]

[REDACTED]

[REDACTED]

92. Dr. Swain’s own results provide additional evidence of the significant heterogeneity in preferences across putative class members. Using the output from Dr. Swain’s estimation of part-worths, it is possible to show that most survey participants do not show a meaningful preference between the “fully in-house” and the “partly outsourced” storage location. This is consistent with the results of Dr. Scott’s consumer preference survey but inconsistent with Dr. Swain’s conclusions of a substantial demand shift resulting from the change in how storage location is disclosed.¹⁵² Specifically, Dr. Swain’s estimation of part-worths generates 10,000

¹⁴⁵ Scott Report, ¶ 8.

¹⁴⁶ APL-ICSTORAGE_00018776–823 at 812.

¹⁴⁷ APL-ICSTORAGE_00021506–568 at 509 ([REDACTED]

at 520 ([REDACTED]

APL-ICSTORAGE_00019628–832 at 718 ([REDACTED]).

¹⁴⁸ Stewart Deposition, p. 27:20–23 (“Q Do you use the family sharing? A No, we don’t have that”); Williams Deposition, p. 21:6–8 (“Q. Do you use Family Sharing? A. My son and I have a family share on my -- my Apple Account. Yes”).

¹⁴⁹ Stewart Deposition, p. 130:20–21 (“Q Do you currently use Find My iPhone? A Yes”); Stewart Deposition, p. 131:2–16 (“Q Do you currently use iCloud to sync your contacts across devices? A Yes. Q Do you currently use iCloud to sync calendars across devices? A Yes. Q Do you currently use iCloud to sync notes across devices? A Yes. Q Do you currently use iCloud to sync reminders across devices? A Yes. Q Do you currently use iCloud to sync bookmarks and tabs? A Yes”); Williams Deposition, p. 40:9–11 (“Q. Are you familiar with the iCloud feature Find My iPhone? A. Yes. I’ve never used it”); Williams Deposition, p. 42:2–7 (“Q. Have you used iCloud to sync address books across devices? A. I don’t have ‘across devices.’ I have one device. So whatever I saved in there, it’s there in the Cloud. The phone. That’s what I do. I save it there. I have one device”).

¹⁵⁰ Scott Report, Exhibit 7-12.

¹⁵¹ APL-ICSTORAGE_00033684–719 at 698.

¹⁵² For example when asked what pieces of information mentioned in a sample “low storage” notice based on the one used by Apple during the Damages Class Period would be most important to them in deciding whether to sign up for

different estimates for the part-worths of each respondent in the Swain Survey.¹⁵³ The range of values for these 10,000 part-worths represents the uncertainty associated with estimating the underlying preferences of each respondent based on their answers to the Swain Survey. Using this measure of uncertainty, it is possible to assess whether a given respondent to the Swain Survey shows a statistically significant preference for either the “fully in-house” or the “partly outsourced” storage location, as opposed to an estimated preference that is not statistically distinguishable from “no preference.”

93. Figure 7 shows that the majority of respondents to the Swain Survey (75%) are indifferent between a “fully in-house” and a “partly outsourced” storage location after accounting for statistical variation in his results. In particular, 75% of respondents to the Swain Survey do not show statistically significant difference between the value of a “fully in-house” and a “partly outsourced” storage location at conventional levels of statistical significance.¹⁵⁴

Figure 7: Swain Survey Respondents’ Preferences for Storage Location

	Number of Respondents	Share of Respondents
Respondents who Statistically Prefer Partially Outsourced Storage over Fully In-House Storage ^[1]	3	1%
Respondents who Statistically Prefer Fully In-House Storage over Partially Outsourced Storage ^[2]	99	24%
Respondents who Do Not Statistically Show Preference for Any Storage Type ^[3]	309	75%
Total number of the respondents	411	100%

Source: Swain Report and production materials

Note:

[1] Respondents who have a negative 97.5th percentile of the posterior distribution for the difference between Fully In-House Storage and Partially Outsourced Storage.

[2] Respondents who have a positive 2.5th percentile of the posterior distribution for the difference between Fully In-House Storage and Partially Outsourced Storage.

[3] Respondents who have a negative 2.5th percentile and a positive 97.5th percentile of the posterior distribution for the difference between Fully In-House Storage and Partially Outsourced Storage.

94. In addition, the finding that the majority of respondents to the Swain Survey do not show a statistically significant preference for storage location provides evidence of the significant uncertainty associated with Dr. Swain’s methodology. While Dr. Swain reports price premiums allegedly paid by Plaintiffs of 34.8% for a 50 GB subscription, 41.7% for a 200 GB subscription,

the iCloud Service, only 4% of respondents to Dr. Scott’s survey mentioned “stored by Apple.” See Scott Report, ¶ 10.

¹⁵³ Each one of these 10,000 estimates can be thought of as a “simulation” or a random “draw” from the probable values of the actual (but unknown) preferences of the 411 respondents to the Swain Survey. Dr. Swain’s estimates are based on the average of part-worth for each respondent.

¹⁵⁴ Reference Guide on Statistics, 211–302 at 245.

and 46.2% for a 2 TB subscription, he does not provide any measure of the uncertainty in these estimates. Dr. Swain's analysis is subject to several sources of uncertainty including (1) the error involved in using a sample of respondents to represent the entire population of millions of putative class members; (2) the uncertainty in estimating consumers' preferences with only ten choice tasks; and (3) the uncertainty arising from the various modeling choices and decisions in Dr. Swain's analysis (such as using "lower", "middle," and "higher" prices instead of the actual market prices). Dr. Swain does not account for these potential sources of error in his analysis and he fails to report any known or potential error rate associated with his estimates.

2. Dr. Swain ignores heterogeneity in consumers' switching costs

95. As I explain in Section VII.A, switching costs are the costs to a consumer of switching from one product to a substitute product. Dr. Swain ignores evidence from multiple sources indicating that iCloud Service users have very different switching costs. Because of these differences, the impact of a but-for disclosure about storage location on the behavior and willingness to pay of these users, if any, may differ significantly by individual to the extent that switching costs play any role in their purchase decisions.

96. Switching costs can vary because of different use cases across iCloud Service users. For example, Mr. Stewart stated that he will continue to pay for the Service as long as he has an Apple desktop computer.¹⁵⁵ Mr. Stewart also explained that his wife could stop paying for iCloud Service because her use of the Service is personal, and unrelated to her work.¹⁵⁶

97. Switching costs may also vary across putative class members because users have different preferences and use patterns for the non-storage features of iCloud—features that they would lose if they switched services. [REDACTED]

[REDACTED]

[REDACTED]

¹⁵⁵ Stewart Deposition, p. 127:13–15 (“Q So is that as long as you have your Apple desktop, you will continue to use iCloud? A Right”).

¹⁵⁶ Stewart Deposition, p. 121:13–22 (“And her situation is different because she rarely uses it as I use it. So she doesn't -- it's more photos for her, you know. It's not -- it's not a daily -- she could -- she could typically probably, you know, use one of the lower tier iCloud service or not at all because she's not tied into the iMac and her desktop because she doesn't use it for work. So it's a little bit different in how my wife uses Apple products”).

¹⁵⁷ APL-ICSTORAGE_00018776–823 at 817.

[REDACTED]

98. Dr. Swain's analysis also fails to consider that consumers' switching costs are likely to be different at the initial signup than they would be after a long usage period. A first-time user would likely not face the cost of having to transfer a large volume of files and data from the iCloud Service to a different cloud storage provider—a cost that would tend to increase the more files a user had stored. Switching costs can also vary across putative class members because they develop platform-specific knowledge that would be lost if they switched services. For example, Mr. Stewart stated that he chose not to buy a Samsung phone because he had invested time and energy researching Apple products.¹⁶⁰ Similarly, Ms. Williams expressed that she would not be willing to learn how to use a different platform because of the difficulty of doing so:

I had a Samsung. I had it for about a year. And then I quickly came back to iPhone...because once you learn a language, at our age it's hard to learn another one. So I struggled for a year, and then I came back to what I understood.... I've learned my lesson. I can't learn another program. I'm done.¹⁶¹

99. [REDACTED]

[REDACTED]

[REDACTED]

Because the Swain Survey does not consider any potential differences in the switching costs of putative class members, Dr. Swain cannot incorporate into his analysis any differences in their preferences and purchasing behavior at different stages of the usage experience. To the extent

¹⁵⁸ APL-ICSTORAGE_00018776–823 at 818.

¹⁵⁹ APL-ICSTORAGE_00036105–87 at 51.

¹⁶⁰ Stewart Deposition, p. 25:8–17 (“...I was never at a point where I felt I wanted to pull the plug just because I've invested so much time ... doing research on the products, purchasing the products because you've walked through a range of products that we purchased over the years”).

¹⁶¹ Williams Deposition, p. 19:3–17.

¹⁶² APL-ICSTORAGE_00036105–87 at 16.

¹⁶³ APL-ICSTORAGE_00036105–87 at 39.

Plaintiffs argue that switching costs can explain the behavior of putative class members, the Swain Survey cannot provide the evidence necessary to support such claims.

100. Overall, because switching costs are likely to vary across members of the Damages Class due to observable and unobservable characteristics, it is difficult or impossible to determine the purchase decisions they would make in the but-for world without individual inquiry.

Furthermore, because switching costs likely vary over time, the market price impact of any change in information also likely varies across time and makes it less plausible that a single survey conducted at the end of the Damages Class Period can generate meaningful inferences about market price impact in the preceding years. Plaintiffs have offered no methodology to account for switching costs either overall or for individual class members.

3. Dr. Swain ignores heterogeneity in consumer information

101. Given the diversity of preferences and switching costs, there is no reason to believe that a change in the information in iCloud's Terms and Conditions would have exactly the same effect across a large group of consumers purchasing different products over many years. First, consumers vary significantly in the degree to which they pay attention to information such as that contained in iCloud's Terms and Conditions. For example, Dr. Scott finds that 40% of iCloud subscribers automatically agreed with the Terms and Conditions without reading them. She also finds that, while approximately 48% of respondents read all or some portions of the Terms and Conditions, 60% of them could not remember any specific topics from them.¹⁶⁴

102. Consumers who were already aware of the information regarding Apple's storage practices would be affected differently than other consumers (or not affected at all) by the addition of Dr. Swain's corrective description about location storage to iCloud's Terms and Conditions, and would have experienced a different (or no) change in demand as a result of the alleged misrepresentation. That is, to the extent that some putative class members—through their own research or knowledge—were aware of the potential for some information stored in the iCloud Service to be stored using Amazon or Microsoft servers, and yet continued to pay for the

¹⁶⁴ Scott Report, ¶ 11.

iCloud Service, these consumers could not have contributed to any change in market price associated with the statement that data are “sent to and stored by” Apple.

103. In fact, there was significant public press starting before the Damages Class Period describing Apple’s storage practices. An article from VentureBeat on September 2011 reports that “Apple’s iCloud runs on two services from its biggest competitors, Microsoft’s Azure and Amazon’s elastic cloud.”¹⁶⁵ An article from the New York Times dated August 24, 2014 reports that “Apple’s iCloud storage service and other parts of Apple, along with operations at several large banks, run inside A.W.S. [Amazon Web Services].”¹⁶⁶ Many other news sources, including Business Insider, S&P, New York Times, and Forbes have noted the fact that Apple uses third-party servers for iCloud storage before and during the Damages Class Period.¹⁶⁷ Similarly, between October 2017 and October 2018, Apple’s privacy policy, which includes a statement regarding iCloud’s use of third-party storage,¹⁶⁸ had more than 2.5 million page views.¹⁶⁹ Thus, at least some consumers were likely aware of the extent to which Apple uses third-party servers to store iCloud Service data.

104. The method proposed by Dr. Swain does not account for any of the differences described above, instead assuming that the demand for the iCloud Service would be affected in the same

¹⁶⁵ “Apple’s iCloud Runs on Microsoft’s Azure and Amazon’s Cloud,” *VentureBeat*, September 3, 2011, <https://venturebeat.com/2011/09/03/icloud-azure-amazon/>.

¹⁶⁶ “Bearing Down on Data Upstarts,” *The New York Times*, August 24, 2014, <https://www.nytimes.com/2014/08/25/technology/box-dropbox-and-hightail-pivot-to-new-business-models.html>.

¹⁶⁷ See, e.g., “If iCloud Runs on Microsoft and Amazon, What the Heck Is Inside That Huge Apple Data Center?,” *Business Insider*, September 4, 2011, <https://www.businessinsider.com/if-icloud-runs-on-microsoft-and-amazon-what-the-heck-is-inside-that-huge-apple-data-center-2011-9>; “Report: Microsoft, Amazon Hosting Apple’s iCloud Service,” *SNL Kagan Media & Communications Report*, September 7, 2011; “Apple’s iCloud Cracked: Lack of Two-Factor Authentication Allows Remote Data Download,” *ZDNet*, October 21, 2013, <https://www.zdnet.com/article/apples-icloud-cracked-lack-of-two-factor-authentication-allows-remote-data-download>; “Customizing Data Storage So It’s Worth Paying For,” *International New York Times*, August 25, 2014; “Exclusive Profile: Andy Jassy of Amazon Web Service (AWS) and His Trillion Dollar Cloud Ambition,” *Forbes*, January 28, 2015, <https://www.forbes.com/sites/siliconangle/2015/01/28/andy-jassy-aws-trillion-dollar-cloud-ambition/>; “As Apple Taps Google Cloud, Does Amazon Face Challenge? Next Up: A Bigger ‘iCloud’? Online Computing Services Said \$25 Billion ‘Windfall’ for Those and Microsoft,” *Investor’s Business Daily*, March 18, 2016; “iCloud and Siri Teams at Odds as Apple Seeks to Move Cloud Services In-House,” *MacRumors*, April 21, 2016, <https://www.macrumors.com/2016/04/21/icloud-siri-teams-at-odds-over-in-house/>; “Apple’s Services Teams to Start Working Together to Improve Siri, Maps, iCloud, and iTunes,” *MacRumors*, October 06, 2016, <https://www.macrumors.com/2016/10/06/apple-services-moving-together-infinite-loop/>; “The AWS Outage Impacted A Lot More Than Amazon,” *Benzinga*, March 1, 2017, <https://www.benzinga.com/analyst-ratings/analyst-color/17/03/9112063/the-aws-outage-impacted-a-lot-more-than-amazon>; “Apple’s iCloud Gets a Boost from Erstwhile Enemy Google,” *CNET News*, February 26, 2018, <https://www.cnet.com/news/apple-picks-google-cloud-for-icloud-service/>; “Google (GOOGL) Set to Launch Filestore, Enhances Service Offerings,” *Yahoo! News*, June 27, 2018, <https://www.yahoo.com/news/google-googl-set-launch-filestore-204000717.html>.

¹⁶⁸ See, e.g., “Privacy Policy,” *Apple*, September 12, 2016 (“iCloud data is stored in encrypted form including when we utilize third-party storage”). See also “Privacy Policy,” *Apple*, September 19, 2017; “Privacy Policy,” *Apple*, December 13, 2017; “Privacy Policy,” *Apple*, January 19, 2018; “Privacy Policy,” *Apple*, May 22, 2018.

¹⁶⁹ See Declaration of Alan Benson in Support of Apple Inc.’s Opposition to Plaintiffs’ Motion for Class Certification, January 26, 2021, and work papers.

way for all users by the challenged conduct. Without properly accounting for variations in consumers' preferences for product attributes, switching costs, and the information available to purchasers regarding the alleged misrepresentation, Dr. Swain can neither reliably calculate aggregate class-wide injury nor assign damages to individual members of the proposed Damages Class.

105. For these reasons, Dr. Swain's assumption of uniform impact to large swaths of the proposed Damages Class (e.g., all class members who bought the 50 GB service at any time) is unsupported and incorrect. As Dr. Mangum's damages methodology critically relies on this assumption, it is also unreliable.

B. Dr. Swain's Conjoint Analysis Generates Estimates of Consumer Preferences That Are Inconsistent with Rational Consumer Behavior

106. If Dr. Swain's conjoint analysis captured the actual preferences of iCloud Service users, one would expect that his measures of preference for the levels of certain attributes (the part-worths) are consistent with consumers preferring better attribute levels over worse attribute levels (e.g., preferring lower prices to higher prices, all else equal). Dr. Swain acknowledges the importance of this concern when he explains that "[s]ome researchers prefer to impose 'constraints' on part-worth utility estimation so that the part-worth patterns obey a pattern that the researcher deems 'rational' or acceptable."¹⁷⁰

107. As explained in a publication sponsored by Sawtooth Software (the firm that creates the software used by Dr. Swain), when estimated part-worths do not show a pattern consistent with "rational" behavior, "[t]his can be a problem, since price utilities with the wrong signs or slopes are likely to produce models yielding nonsense results. Perhaps even more important, anomalous part-worths can undermine users' confidence in the results."¹⁷¹ I understand from Dr. Scott that the Swain Survey suffers from multiple fatal flaws, such as failing to incorporate key attributes of the iCloud Service and cloud storage providers, or failing to account for the fact that consumers may pay for more than one cloud storage platform.¹⁷² Dr. Scott notes that the decision

¹⁷⁰ Swain Report, ¶ 77.

¹⁷¹ Johnson, R. M. (2000), "Monotonicity Constraints in Choice-Based Conjoint with Hierarchical Bayes," *Sawtooth Software Research Paper Series*, p. 1.

¹⁷² Scott Report, Section IV.E.

environment in the actual world differs substantially from the decision environment presented in the conjoint survey, which could cause consumers to make different and perhaps inconsistent choices in the Swain Survey compared to what they would have made in the actual market.¹⁷³ Potentially as a result of these flaws, Dr. Swain's analysis generates estimates of consumer preferences that are inconsistent with rational consumer behavior.

108. Dr. Swain states that "a large majority of respondents in [his] conjoint survey exhibited higher relative utility for lower prices" and that imposing the constraint that respondents prefer lower prices to higher prices in his model does not have a "material impact" on his results.¹⁷⁴ Dr. Swain, however, does not explain what a "large majority" means,¹⁷⁵ or how he determined whether a respondent exhibited higher relative utility for lower prices. Furthermore, Dr. Swain did not analyze his results to assess rational preferences in the part-worths for other attributes in his survey. Specifically, Dr. Swain did not analyze if respondents to his survey would prefer to have one user per account rather than the option of up to six users, or would prefer the option to sync with fewer rather than more operating systems.

109. Figure 8 presents an analysis of whether respondents to the Swain Survey show irrational preferences in the price attribute, the "family share" attribute, the "multi-device sync" attribute, or across any of these three attributes. Figure 8 analyzes the "rationality" of respondents' preferences based on the average part-worths estimated by Dr. Swain for each respondent.¹⁷⁶ Based on this metric, two-thirds of the respondents, or 272 out of 411 respondents, show an irrational preference in at least one of the three attributes analyzed. In addition, 30% of respondents prefer higher prices to lower prices, 39% prefer syncing with fewer operating systems rather than more, and 17% prefer one user to multiple users.

¹⁷³ Scott Report, ¶¶ 15, 70.

¹⁷⁴ Swain Report, ¶ 78.

¹⁷⁵ Dr. Swain's supporting materials did not contain a calculation of the number of respondents showing irrational preferences for higher rather than lower prices.

¹⁷⁶ These average part-worths are the key input to Dr. Swain's simulation analysis.

Figure 8: Respondents with Irrational Average Preferences^[1]

	Number of Respondents	Share of Respondents
Prefers a higher price than a lower price ^[2]	123	30%
Prefers syncing over fewer platforms than over more platforms ^[3]	162	39%
Prefers only one user than up to six users ^[4]	70	17%
Has at least one irrational preference ^[5]	272	66%

Source: Swain Report and production materials

Note:

[1] Irrational preferences for each of 411 respondents in Dr. Swain's conjoint analysis are determined by comparing the average part-worths, calculated across the 10,000 simulation draws generated by Dr. Swain's estimation method.

[2] Irrationality in price levels is identified if either price level 2 is preferred to price level 1, or price level 3 is preferred to price level 2.

[3] Irrationality in multi-device syncing is identified if a respondent prefers multi-device syncing across iOS, MacOS, and PC to syncing across iOS, MacOS, PC, and Android.

[4] Irrationality in the maximum number of users is identified if a respondent prefers the option of being able to add one user to the account to the option of being able to add up to six users.

[5] Counts respondents that show at least one irrational preference in either price levels, in platform syncing, or in the number of users per account

110. Figure 9 shows an alternative way to analyze whether respondents to the Swain Survey show irrational preferences across the same attributes. To consider the uncertainty inherent in Dr. Swain's estimates, instead of focusing on the average part-worths for each respondent, this analysis considers the 10,000 part-worths estimated by Dr. Swain for each respondent that are used to form the average part-worth used in his simulations. For each of the 10,000 "draws" generated by Dr. Swain,¹⁷⁷ one can count the number of respondents in each draw that present irrational preferences based on their part-worths. Figure 9 shows that Dr. Swain's analysis consistently generates irrational estimates of preferences for a large number of respondents to his survey. In the median case, 81% of respondents show some form of irrational preference, and in the worst case, Dr. Swain estimated irrational preferences for 367 out of 411 (or 89%) respondents his survey.

¹⁷⁷ Each draw includes the estimated part-worths for each one of the 411 respondents to Dr. Swain's survey.

Figure 9: Irrational Preferences over Individual Draws^[1]

	Number of Respondents			Median as a Percentage of Total ^[2]
	Min	Median	Max	
Prefers a higher price than a lower price ^[3]	158	210	263	51.1%
Prefers syncing over fewer platforms than over more platforms ^[4]	137	174	222	42.3%
Prefers only one user than up to 6 users ^[5]	77	109	142	26.5%
Has at least one irrational preference ^[6]	292	333	367	81.0%

Source: Swain Report and production materials

Note:

[1] Summary statistics of the count of respondents with irrational preferences across the 10,000 “draws” generated by Dr. Swain.

[2] Percentage of 411 total number of respondents to the Swain Survey.

[3] Irrationality in price levels is identified if either price level 2 is preferred to price level 1, or price level 3 is preferred to price level 2.

[4] Irrationality in multi-device syncing is identified if a respondent prefers multi-device syncing across iOS, MacOS, and PC to syncing across iOS, MacOS, PC, and Android.

[5] Irrationality in the maximum number of users is identified if a respondent prefers the option of being able to add one user to the account to the option of being able to add up to six users.

[6] Counts of respondents that show at least one irrational preference in either price levels, in platform syncing, or in the number of users per account.



Lorin M. Hitt

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